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THE

ASSURANCE MAGAZINE,

AND

JOURNAL

OF THE

INSTITUTE OF ACTUARIES.

VOL. VIII.

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ERRATA.

Page 58, line 11 from bottom:—

For N_x , read N_{x-1} ; and for $m.D_{x+n}$, read $m(D_{x+n} - M_{x+n})$.

THE
ASSURANCE MAGAZINE,
AND
JOURNAL
OF THE
INSTITUTE OF ACTUARIES.

On the Settlement of Losses by Fire under Average Policies. By
RICHARD ATKINS, Esq., *Sun Fire Office.*

SINCE the last article on the settlement of fire-claims under average policies appeared (April, 1857), a very important change has been adopted. The third clause of the Liverpool floating policies, known under the title of the "independent liability clause," has been introduced, by the common consent of nearly all the Insurance Companies, and made part of the conditions of all London mercantile floating policies. The alteration is, beyond all doubt, a very considerable one in its practical effect. It will change entirely the mutual relation of the Companies in very many cases of joint insurances, and, if very great care be not taken at the outset, introduce no small share of doubt and difficulty in the relation of the Offices with the assured. It may, therefore, be worth while to offer a few remarks at the present moment on the change actually effected by the recent alteration of the average clause, and then make some practical suggestions as to the regulation of claims under the altered form of policy.

The first and, by far, the most important point to be noted, is, that the old empirical and unjust system fixing the policy of smaller range with priority of settlement, ceases its operation; so far, at least, as London mercantile insurances are concerned. A more just and intelligent rule is substituted. All average policies

covering, at any point, the same risk, are to be called to take their share in settlement and pay their proportion according to their ascertained liabilities. In a very short time, it will be a matter of curiosity and wonder to reflect upon the strange character of the old rule, which has prevailed and been quietly submitted to for so long a period. In any case, no one will be found of the opinion that the change recently made has been either a hasty or a premature measure.

The satisfaction derived from the contemplation of this judicious and necessary regulation is very considerably modified by the conviction of its incompleteness. There is so much left untouched, that future and, probably, not distant legislation will be urgently required. For example: the rule of calling upon specified policies to settle first, and which is still maintained in the second clause of the present average condition, is open to identically the same objections as in the case of limited averages. Why should a specified policy be called upon often to pay the whole loss, while an average policy, covering also the same goods, escapes? No better reason can be given for this portion of the old rule than for that which has been abandoned by general consent. The rule probably had its origin in the purpose of regulating losses where different kinds of policies existed in the same Office. This has been taken up and misapplied in the cases where such varied forms of policies exist in *different* Companies. The universal condition of specified policies is, that in case an insurance on the same property should be made in another Office, then each Office should bear its proportion of the loss. Upon what principle is it that the Company issuing an average policy inserts a clause declaring that the specified policy is bound to settle first, and abandon its own condition of paying only *pro rata*—thus furnishing the spectacle of one Office practically annulling, by its own act, the conditions of another Company?

Office A executes a specified policy, and inserts a condition, that, if the same property is jointly insured, a rateable proportion only is to be paid. On the other hand, Office S, which *does* cover the same property, although under a different form, sees fit to declare, that, in case of loss, the Office A must waive its own condition and bear the first brunt of the loss. It is not difficult to discern the reason for treating such varied policies when issued by one Company in the manner prescribed; but no better reason can be assigned for Office A allowing Office S to annul the condition of its policy in the manner referred to, than the intention which A has

to return the compliment in kind at the first opportunity which may present itself.

It cannot be alleged that any real difficulty exists in arriving at the respective proportionate claims of a specified and an average policy. The liability of each, separately ascertained, is the simple test of the proportion which each has to pay. The rule in such a case may be shortly stated, thus :—The amount of *liability* of every specified policy is the whole amount of loss, as far as the sum insured : on the other hand, the amount of *liability* of an average policy is, such a proportion of the loss as the sum insured bears to the value of the property covered. When these two liabilities, taken collectively, do not exceed the amount of loss, then each pays the whole amount of its liability ; but when they exceed the total loss, then each settles on a *pro ratâ* calculation of the separate liabilities.

As the extension of the principle which affirms that joint average policies shall have a joint action in the settlement of claims, is now admitted, so, in like cases, joint specified and average policies would not involve any practical difficulty. It is to be regretted, that while an important alteration has been effected, it has not been made complete in this respect. The omission of the second clause in the present average form would have had the advantage of placing specified policies on the same footing as the more limited averages are now placed ; thus introducing harmony into the different kinds of settlement, and at the same time establishing what is, in effect, a more clear and equitable rule.

It is also a subject of some regret, that the alteration made in the London average form was not extended at the same time to all average forms, and made to apply everywhere. It is understood that no change is to be made in the Liverpool mercantile policies. The old rule of the more limited range settling first will still be maintained, in all its integrity, in that large emporium of commerce. The practice which has been declared in London to be vicious, and to stand in need of alteration, is to be, for the present at least, upheld in this one important branch of business. It is not probable, indeed, that this can be any other than a temporary and transitory arrangement. The objections to the old system will be held, at no distant day, to be as unanswerable in the port of Liverpool as in the port of London. A heavy loss to be paid on a cotton-shed, with average clause, or under a dock or certified warehouse policy—while the wider range, or general floater, takes only a subordinate part, or possibly no part at all—will one day

give irresistible weight to the argument for change. The general adoption and application of the improved principle may be anticipated, with complete confidence, as likely to happen at an early date. In the meantime, it is presumed that the additional clause will form part of the average clause in all other branches of English business.

At the next opportunity, when the subject is under discussion, it will be highly desirable that the form itself of the average clause should undergo revision, with a view to alteration. The present form is unnecessarily diffuse—wordy—and is very far, indeed, from being lucid to any who are not already familiar with the subject. It might be with great advantage abridged, and would certainly become more intelligible in the process. Many improved forms have been at different times suggested; and, in the absence of any other or better, the following might serve as the basis for a remodelled declaration of average.

It is hereby declared and agreed, that this Company shall be liable only for such a proportion of any loss as the sum insured by this policy may bear to the full value of the property covered.

And it is further declared and agreed, that if the assured shall be also insured by any other Company on property wholly or partly covered by this policy, then this Company will bear its share of the loss in the proportion that the amount of its liability may bear to the amount of the liability of any other policy, separately ascertained by the rule of its own conditions.

This latter subject (the alteration of the clause) is, however, one which may be very conveniently laid aside until a suitable occasion for its discussion arises; and, in the mean time, it can be thought over; and preparation made for making the change, when it comes, more complete and effective.

The addition of the third clause to the two, forming the average clause (*see* the Number for April, 1857), which now forms part of the London mercantile policies, will be productive of very considerable practical results. These will appear in two directions: there will be the influence of the rules on the adjustment of claims among the Offices interested, and also those which regulate the settlement of losses between the Offices and the assured.

The settlement of claims among the different Companies, when jointly interested, will, in not a few cases—indeed, generally—assume a very simple form. A slight examination, however, will suffice to show that, for many others, clear rules are necessary to be promptly established, in order to exclude the risk of wide differences of opinion.

Take one or two of the most common forms of combination: a policy for merchandise in the docks, in Office A; one on goods in the wharves and docks, in Office P; and another general floater, including both docks and wharves, in Office S. A loss may happen in either range: first, in the docks; second, in the wharves; third, in a public warehouse, not included in either of the former. We have already seen, in former articles, in what manner the existing rules of settlement operate in each of these cases; the object of our present inquiry is, what will be the practical difference made by the introduction of the new clause.

Insurances.	Property.
Office A, £5,000 docks	£10,000 docks.
„ P, £10,000 docks and wharves	5,000 wharves.
„ S, £5,000 general floater	5,000 elsewhere.
Loss, £6,000 in docks.	

The former rule, as we know, would have compelled the settlement of this claim in the order of the extent of ranges. The present rule inquires for the amount of liability of each Office, independently taken, as though no policy but itself existed, and will give this result:—

	£
Liability of A, as £5,000 to £10,000—say, $\frac{1}{2}$ of loss	3,000
„ of P, as £10,000 to £15,000— „ $\frac{2}{3}$ of loss	4,000
„ of S, as £5,000 to £20,000— „ $\frac{1}{4}$ of loss	1,500
Total liabilities	£8,500

to pay the loss of £6,000. Each Office will then pay its share *pro ratâ*.

In this case, the sum of liabilities is seen to exceed the amount of loss, which brings the policies into apparent contact or dependence. It is obvious that it must be according as the distribution of property brings the joint liabilities up to, or to exceed, the amount of loss, that this kind of modified dependence is created. In all cases where the joint liabilities do not equal the amount of loss, each policy is strictly independent of the other, and settles and pays as though no other policy were in force. Take the same insurances—

Insurances.	Property.
Office A, £5,000 docks	£10,000 docks.
„ P, £10,000 docks and wharves	30,000 wharves.
„ S, £5,000 general floater	10,000 elsewhere.
Loss, £6,000 docks.	

	£
Liability of A, as £5,000 to £10,000— $\frac{1}{2}$ of loss .	3,000
„ of P, as £10,000 to £40,000— $\frac{1}{4}$ of loss .	1,500
„ of S, as £5,000 to £50,000— $\frac{1}{10}$ of loss .	600
	<hr/>
Total independent liabilities .	£5,100

Here it is seen that the aggregate sum of liabilities does not reach the amount of loss, and the policies are throughout strictly independent.

There is no ground for anticipating that any real practical difficulty will arise whenever the loss happens under circumstances that the whole of the policies are interested. Each can ascertain its own liability; and, upon this basis, the settlement may be made quite equitably to all the parties concerned. But where the loss occurs where all the Offices are *not* interested—say, with the policies just stated, in a wharf or in a warehouse, not in a dock or in a wharf—can a strict independence be then maintained, and the claim settled, without reference to existing policies not affected by the fire? Will the policies covering the lesser ranges—not extending to the place of the fire—be allowed to be exhibited, and brought in deduction of the amount of goods covered? To make the case clear, take, as before—

Insurances.	Property.
Office A, £5,000 docks . . .	£10,000 docks.
„ P, £10,000 docks and wharves .	5,000 wharves.
„ S, £5,000 general floater . .	5,000 elsewhere.
Loss, £3,000 on a wharf.	

A strictly independent settlement would be—

	£
Liability of P, as £10,000 to £15,000— $\frac{2}{3}$ of loss .	2,000
„ of S, as £5,000 to £20,000— $\frac{1}{4}$ of loss .	750
	<hr/>
	£2,750

Here the question is at once raised,—Ought the policy of A, £5,000 docks, to be brought into account, and allowed in deduction of the sum of property covered in the average statement? This important question, certainly not free from difficulty, may give rise to conflicting opinions, and the sooner it is met and answered the better. It is just one of those points which are so much easier to decide before a loss happens than afterwards, when heavy claims are to be adjusted among the disputants.

It may be shown (*see* article of April, 1857), that a strict construction of the independent liability principle does not admit, for

a moment, of any such rule of settlement. What has the Office with the wider range to do more than the declared conditions of its policy prescribe? Office P declares, by its policy, that it will pay such a proportion of the loss only as the sum insured bears to the value of the property; or, if jointly insured, in the place of loss with other Companies, pay *pro rata* with them. But why should the loss of P be *increased* by the fact of another insurance, not touching the fire, existing in Office A? For if the deduction of the policy of A be admitted, that rule of settlement would add to the loss of P £250 in the case just stated.

It may also be alleged, that there is not a word in the third clause, lately adopted, to sanction the practice; that clause does not go a step beyond a declaration of strict independence. Furthermore, although it is true that the strict construction of the clause would bear, in many cases, very hard upon the assured, it is clearly the fault of the assured himself in arranging his policies in a needlessly complicated form, with no other view or purpose than to save a small fraction of premium, and it is but just that he should take the consequences. Why should the uniform action of a sound rule be broken into to afford facilities for the assured to save a small margin of premium? To all this it might be added, with truth, that the principle of deducting the policies for the smaller limits is open to many grave objections, not the least of which is to be found in the uncertainty of defining, in many supposable combinations, what deductions should be admitted and what excluded, on the ground of greater or less extent of area.

There is one point of view in which a strict observance of the independent liability principle, in all its rigour, would produce results certain to be welcome to the manager of every Fire Insurance Company in the kingdom. Such an interpretation would very speedily bring to an end all those complicated combinations of average ranges which, at the present time, render it impossible to form even an approximate estimate of the total liabilities of the Companies in any one range. With policies running over one dock, —all the docks—wharves, including docks—public warehouses, including wharves and docks,—how can any manager form even a rude guess at what may be the total amount covered by his Company in any one range? Act, however, upon the rule of independent liability in its integrity; refuse, in short, to allow the exhibition of a policy for a minor range to be brought in a settlement of claim in deduction of the goods covered, and a great step will doubtless be made towards effecting a most desirable object.

The results would be immediate. All the different ranges must then be kept entirely distinct. There could no longer co-exist policies either in one Office or in several, with ranges running into, or (if the expression may be used) overlapping each other. We should then see policies for the docks—policies for the wharves, not including the docks—policies for the public warehouses, not including either docks or wharves—or, if these natural divisions did not suit the objects, or the peculiar trade of the assured, there would be the six miles floater, including all and excepting none.

It is very true that this arrangement of policies would not give all the materials for an exact account of the running liabilities of a Company; but the advantage in Offices of having to deal with policies thus classed, in making estimates of amounts of outstanding liabilities, need not be further expatiated upon or explained.

The object (if ever it should be attempted) would be best attained by submitting to the public the detailed forms of the proposed mercantile policies, upon the understanding that they must each be kept clear of the other—each form being subject, in case of claim, to its own independent average calculation. The following clause (or something like it) might then be added to the conditions, in order to remove all doubt or possible misapprehension.

It is also declared and agreed that, if the assured has insured, by a separate policy or policies, with this or any other Company, for property in one or more of the warehouses or places within the range of this policy, then this policy will not extend to cover any goods in the said warehouse or warehouses thus separately insured.

This appears, at the first glance, to be a somewhat inviting view, and strongly to favour a strict interpretation of the new third clause; but on deliberate reflection it will be found, it is to be feared, quite impracticable. Sudden alterations of system, where large bodies of the public are concerned, are generally impolitic. Our present system has been one of long growth, and will with difficulty bear an entire change. The London merchants have been long used to the great facilities offered them by the mixed forms of floating policies referred to; and restrictions, suddenly adopted, would be justly viewed by them with distrust and suspicion. The plan of issuing only limited forms for ranges not touching each other, might be a very fair object for the Companies to aim at; but it would not prove, by any means, an easy task to convince the mercantile community that sufficient reasons existed for the sudden abolition of the old freedom allowed to their insurance operations. In any view of the case, the time does not appear

to have arrived for making an attempt at so considerable an alteration.

This being conceded, the rule of treating the sums insured by limited average policies in the same manner as specified policies are treated in the settlement of claims, must necessarily become of general adoption. Wherever the assured has policies of different ranges, and a loss happens in one or other of the more extended ranges, he must be allowed (in spite of all rules or theories to the contrary) to set off from the amount of property covered the amount he has specifically insured in the limited range or ranges.

A plain case or two will make the rule perfectly intelligible to those who may not be familiar with the subject.

Insurances.	Property.
Office A, £5,000 docks	£5,000 docks.
„ G, £5,000 docks and wharves . .	5,000 wharves.
Loss, £5,000 wharves.	

If the dock insurance is to be dealt with (as it must) as a specified policy, the calculation proceeds—as £5,000 is to £10,000; but deducting the dock policy—as £5,000 to £5,000; making the whole loss (£5,000) to be paid by Office G. On the strict construction of the third clause, the policy of A would not be permitted to be exhibited in reduction of property covered by G. This would give a settlement to G of £2,500, instead of £5,000, and the assured would recover only the half of his loss, although, as far as the total amount of insurance was concerned, he was fully covered.

A glance at this simple case shows that such mixed forms of policies could never be issued on the one side, nor accepted on the other, if such a construction of the clause were to be attempted. Such policies, and such a construction of the clause, cannot possibly coexist. It would be, no doubt, a very efficient weapon to compel an alteration in the forms of mercantile policies, and to enforce the rule that all classes should be kept distinct; but, until it is thought politic to attempt that alteration, the rule of deduction must, beyond all doubt, be held as the rule of settlement.

It being, then, abundantly clear that the rule formerly practised, of admitting in ordinary settlements the exhibition of policies for minor ranges in deduction from the sum covered, must be maintained and steadily acted on, the duty of the assessors of claims will be made easy by a general understanding taking place to govern their operations—the rule being, that lesser ranges of average policies are to be held in the same light and treated as speci-

fied policies, deducting the sum of such policies in the average statement as specifically covering that amount of the goods under the protection of the wider policy.

In the case of the London mercantile policies, the process of adjustment may often appear somewhat involved, from the various forms and ranges simultaneously in force. For example: there may be—1, a policy for one dock (say the London); 2, a policy for all the docks; 3, a policy for some wharves named and the docks; 4, a policy for all the wharves and docks; 5, a six miles policy, including all except the carriers' warehouses; 6, a six miles policy including the carriers.

A loss happening in the London Docks, all are directly interested, and there will be six liabilities to be independently estimated—all six paying each its quota part. A loss occurring at the St. Katharine Dock, under policy No. 2, there will then be five ranges interested, and each is required to make its own average calculation; but, in that case, the policy No. 1 must be allowed to be brought in deduction from the sum covered. Again, a loss in a warehouse not on a wharf or in the docks, under No. 5, Nos. 5 and 6 only would deal with the claim, while Nos. 1, 2, 3 and 4, would be shown for deduction. Finally, a loss in a carrier's warehouse would fall only on No. 6, the whole of the others appearing in the shape of a reduction of the amount of property covered, as though they had each been specified insurances.

The process described in the last paragraph has not the least pretension to the character of novelty; it is merely a continuation of the existing rule of settlement; and the only object of now describing it with some minuteness, is to prevent any risk of misapprehension on the part of those who may be called upon to apply the new third clause in the regulation of claims. That clause, as we have seen, alters fundamentally the process of adjustment among the Offices whose policies range over the place of the fire, and thus have a liability in common; but it leaves untouched the former laws of settlement as to those which cover specifically, or by a minor average range, a portion of the property included within the limits of the wider area.

Enough, and possibly more than enough, has been now said on the subject; and the entire object of these remarks will have been attained, if a clear and well-defined idea of the nature and extent of the change made by the recent alterations in the average form is promoted among those who are called upon to give practical effect to it in the adjustment of claims.

Before closing the article, it may be not without its use to those who are looking into the subject for the purpose of instruction, to specify, in an abridged form, some few of the points necessary to be borne in mind when looking for principles which lie a little below the surface. They are merely a repetition, in a condensed form, of statements already made in the present and former articles.

1. The amount of *liability* of every specified policy is the whole amount of loss, as far as the sum insured. The value of the whole property covered at the time of the fire forms no part of the inquiry.

2. In all cases where the sum of an average policy is equal to, or greater than, the property covered within its range, it becomes in all respects a specified policy, and has no advantage over it. The operation of the average principle has ceased to have any distinctive effect in the settlement.

3. Joint insurances of specified policies are quite *independent* of each other when their united sums are only equal to, or less than, the loss.

4. Joint average insurances are in like manner *independent* of each other when the sum of their *liabilities* is only equal to, or less than, the loss.

5. The only cases where the Offices are brought into contact, are when the gross amount of specified policies exceeds the amount of loss. In the same way are average policies brought into mutual dependence, when the united liabilities exceed the loss. The proportional settlement between the Offices proceeds in exactly the same form in both cases.

6. It follows, then, that so soon as the liabilities of average policies are independently ascertained, there is no difference of treatment between the amounts of those liabilities and similar amounts insured in the place of the fire by specified policies.

A portion of these remarks may possibly appear, to those well informed on the subject, as a useless repetition of trite and well-known principles. To this criticism the only answer needed is, that they are not intended for those who already know, but for those who do not know, the method of working these average problems. Of all the merchants who effect policies of this description, and whose interests are so deeply involved, how many really appreciate or comprehend the conditions of their policies? And as to those whose business it is, in the various Offices, to explain, while accepting risks, the practical operation of the clauses, and

those also who are called upon in case of loss to adjust the claims, it is not saying at all too much to remark, that there are not a few who will be the better for a renewed and thoughtful attention to the points discussed. To this it may be added, that if all those whose duty it is to understand the subject, but who do not, will only give a patient hearing to what has now been advanced, there will be an audience quite numerous enough to satisfy the ambition of the writer.

On the Value of Policies of Assurance in connection with Life Interests. By T. B. SPRAGUE, M.A., F.I.A., Actuary to the Liverpool and London Insurance Company.

IN the course of an actuary's practice, the question not uncommonly arises—What is the value of a life interest, accompanied by a policy of assurance on the same life? The most obvious course for solving this question is to value the life interest and the policy separately—the former by the well-known formula, $\frac{1}{p+d} - 1$.*

With regard to the policy, it is not so clear how it should be valued. If valued on the same principles as the life interest, the value of a policy for £1 would be $1 - (p+d)(1+\Lambda)$;† but this formula is quite inapplicable, for it gives a negative value for many years to a policy, and almost always a much smaller value than the surrender value allowed by the Office. There is, therefore, apparently no choice but to take the value of the policy at the latter amount.

By taking the policy, however, in connection with the life interest, we are able to attach a more definite value to it, as I shall now proceed to show. The method I am going to describe is one that has doubtless occurred to many other persons who have had occasion to think over the question; but as the subject

* This formula was first given by Mr. Griffith Davies: it coincides with the less elegant one given in *Jones on Annuities*, art. 246, $s = a \cdot \frac{1-p(1+i)}{i+p(1+i)}$, which may be reduced to the form in the text by the help of the formula $d = \frac{i}{1+i}$. A proof of the formula, as well as of some very useful and practical extensions of it, is given by Mr. Jellicoe in the *Assurance Magazine*, vol. ii., p. 159.

† The value of a reversion, as given in Mr. Jellicoe's paper already referred to, is $1 - d(1+\Lambda)$. In the case of a policy for £1, we must subtract from this value the cost of an annuity equal to the annual premium, or $p(1+\Lambda)$, giving the value of the policy as stated in the text, $1 - (p+d)(1+\Lambda)$.

is one of practical interest, I think no apology is necessary for bringing it before the readers of the *Assurance Magazine*.

The purchaser of a life interest, in order to protect himself from loss by the premature death of the life on which it depends, must effect a policy of assurance on the life; and the same principles of valuation which fix the value of the life interest at $\frac{1}{p+d}-1$, show that the proper amount of the policy to be effected is $\frac{1}{p+d}$. Hence, if I be the value of a life interest of £1, the proper amount (S) of the policy to cover an annuity of £ a , is $(1+I)a$; and conversely, a policy for the sum S will cover an annuity of $\frac{S}{1+I}$, or $S(p+d)$. Supposing a policy to be effected for the full amount $\frac{1}{p+d}$, it is seen that after the lapse of any number of years, the value of the life interest and policy together will always be the same, viz., $\frac{1}{p+d}-1$; the annuity providing for the premium of insurance and the interest on the outlay during the continuance of the life, and the policy returning the capital on the extinction of the life. It is thus seen that the policy here has a definite value, which is in fact the difference between the original value of the life interest and its value at the advanced age. I shall give further on a general expression for this value.

The value of a life interest and of the *corresponding policy* being thus easily found, we are led to the following rule for valuing a life interest only partially covered by a policy:—"Determine how much of the annuity is covered by the policy, and find the value of that portion and of the policy together, as shown above; then value the remainder of the annuity in the ordinary way."

To take an example:—Suppose it is required to find the value of an annuity of £100 during the continuance of a life that can now be insured at £3. 10s. per cent, together with a policy for £500 on the same life, effected some years back at £2. 10s. per cent. The value of a life interest of £1, when the premium of insurance is £2. 10s., will, by the formula already quoted, be £12.770 (d being taken equal to .04762, which supposes that the purchaser makes 5 per cent. on his outlay). The policy to cover the interest completely should be for the sum of £13.770; hence, by proportion, the policy for £500 will cover an annuity of £36.31, and the value of this annuity and the policy together will be £500—£36.31, or

£463·69. At the increased premium £3. 10s., the value of a life interest of £1 will be £11·1036, and the value of the remaining annuity of £63·69 will therefore be £707·188. Adding to this amount the value found above, we find the value of the proposed life interest and policy together to be £1170·878.

If the life interest were valued without the policy, its value would be only £1110·360; so that the value of the policy, considered in conjunction with the life interest, is £60·518, which is equal to the difference between the value of an annuity of £36·31 when p is taken equal to ·035, and the value of the same annuity when p is ·025.

What precedes will, I think, be sufficient to show how the case proposed is to be dealt with: I will now proceed to obtain algebraical expressions for the values of the policy and of the annuity. Suppose that a policy is effected at the rate p_1 to cover a life interest of £1, and that after the lapse of n years the premium is p_2 ; then the original value of the life interest being $\frac{1}{p_1+d} - 1$, this will be the value of the life interest and policy together at the end of n years; but the value of the former after n years will be $\frac{1}{p_2+d} - 1$; therefore the value of the policy after n years is $\frac{p_2-p_1}{(p_1+d)(p_2+d)}$. Again, since the amount of the policy is $\frac{1}{p_1+d}$, the value of a policy for £1 will be $\frac{p_2-p_1}{p_2+d}$; or, if I denote the value of the life interest of £1 at the increased age, since $I = \frac{1}{p_2+d} - 1$, the value of the policy for £1 will be

$$(p_2-p_1)(1+I) \quad . \quad . \quad . \quad (1)$$

It will be noticed that this expression is in close analogy to the well-known one for the value of a policy—

$$(p_{m+n}-p_m)(1+a_{m+n}) \quad . \quad . \quad . \quad (2)$$

given in *Jones on Annuities*, art. 254; but it must be remembered that p_m and p_{m+n} here denote the *net* premiums, while in our formula p_1 and p_2 denote those actually payable.

It may also be remarked, that the value of a policy to the holder, who wishes to continue it, is

$$(p_2-p_1)(1+A) \quad . \quad . \quad . \quad (3)$$

where A is now the value of an annuity at the price at which he

could purchase it from a respectable Company, and may be taken at Carlisle $3\frac{1}{2}$ per cent.

The formula (1) gives the value of a policy for £1 when considered in connection with the corresponding life interest. For the general case proposed we proceed as follows:—Suppose the life interest is £A per annum, and that a policy for £S has been effected on the life at the premium p_1 for £1; also that the premium that would have to be paid now is p_2 for £1. At the original premium the value of a life interest of £1 is $\frac{1}{p_1+d}-1$, and the policy to cover it would be for the amount $\frac{1}{p_1+d}$: hence a policy for S would cover a life interest of $S(p_1+d)$, and the value of the life interest and policy together will be $S(1-p_1-d)$. The portion of the annuity not covered by the policy is $A-S(p_1+d)$, and the value of it is $\left\{A-S(p_1+d)\right\} \left\{\frac{1}{p_2+d}-1\right\}$. Adding to this the former value, $S(1-p_1-d)$, the value of the life interest and policy together is

$$\begin{aligned} & A\left(\frac{1}{p_2+d}-1\right) - \frac{p_1+d}{p_2+d}S + S \\ &= A\left(\frac{1}{p_2+d}-1\right) + \frac{p_2-p_1}{p_2+d}S. \end{aligned}$$

Let I denote the value of the life interest when the premium is p_2 , then $I = \frac{1}{p_2+d}-1$, and the expression last written down becomes

$$AI + S(p_2-p_1).(1+I). \quad . \quad . \quad (4)$$

In this result, AI is the value of the life interest at the advanced age. The other term of the value is the amount by which the value of the life interest is increased, in consequence of having the policy of assurance attached to it; and is at once seen to be the value of a policy for the sum S, calculated by the formula (1). Hence, in place of the rule given previously, we may adopt the following, which indeed might have been anticipated:—"Value the life interest in the ordinary way, and add to the result the value of the policy calculated by the formula (1)."

This will be a rather simpler course in practice. Thus, to take our former example,

$$p_1 = .025, \quad p_2 = .035, \quad I = \frac{1}{p_2+d} - 1 = 11.1036;$$

so that the value of the policy is $S(p_2-p_1)(1+I) = 60.518$, which, added to AI or £1110.360, gives the value of the annuity

and policy together, £1170·878, as before. It will be interesting to compare the value of the policy as thus found with the ordinary value. Suppose that it was taken out at the age 36, and has been 10 years in force, then the value by the Carlisle Table, at 3 per cent, is £67·715. The value to the holder, as given by the formula (3), is £78·485.

In all that precedes, I have supposed that the policy is smaller than is required to cover the life interest entirely. If the contrary is the case, and the policy is in excess of the amount required, we shall have to determine how much of it is required to secure the life interest; and the value of this portion and of the life interest is determined in the manner pointed out above. The remaining part of the policy must be valued separately, and it will in general be most practical to estimate it at the Office value; since on the one hand, it must not be taken at a less value than can actually be obtained for it, and on the other hand, it will not in general be worth more to a purchaser.

I have thought it would be a useful addition to this paper to give a table to facilitate the valuation of life interests and contingent reversionary annuities, by means of the formula $\frac{1}{p+d} - 1$.

Such a table has already been given by Mr. Griffith Davies, *viz.*, No. XXV in his work on Life Assurance. He has there tabulated the value of a life interest for all ages from 21 to 65, for the three cases in which the purchaser makes 5, 6, and 7 per cent on his outlay, and on the supposition that the premiums for the assurance are those charged by the "Equitable" Society. But in practice these will not generally be the rates charged; and indeed, the premiums charged by the various Companies differ so widely, that it would be impossible to select any table of premiums that would meet with general approval. In valuing a life interest, each actuary will probably either use the non-participating rates charged by his own Company, or some average rate deduced from the premiums of the Companies with which he would effect the necessary re-assurances. For this reason, it has seemed the more desirable course to tabulate the value of the quantity $\frac{1}{p+d} - 1$ for all values of the premium for £100, from £1. 10s. to £8., at intervals of 1s., these being the extreme premiums that are likely to occur in practice. Then, the proper premium for any age being fixed upon, the value of the life interest is given by the table, when the premium is an exact number of pounds and shillings.

This value is calculated on the supposition that the purchaser makes 5 per cent on his outlay, as I believe that to be the rate of interest which is almost invariably used in these transactions. For intermediate rates, an interpolation is necessary, which may be performed mentally; and to assist this, the differences between successive values are given in the column headed Δ . Thus, supposing the rate to be £2. 12s. 4d., the value of an annuity when the premium is £2. 12s. is £12·583, and the difference in this value for a difference of 1s. in the premium being ·091, the difference for 4d. will be ·030, which must be subtracted, making the value of the annuity £12·553. When the number of pence in the premium is greater than six, it will be more convenient to take the higher premium and make an additive correction. Thus, supposing the premium to be £4. 5s. 10d., the annuity for £4. 6s. is £10·035, to which must be added ·010 for the 2d. by which the assigned premium falls short of £4. 6s., making the value required £10·045.

The values have been calculated by the help of Barlow's Table of Reciprocals, taking in the first instance $d = \cdot04762$, and making the requisite correction when the difference between the above and the true value $\cdot04761905$ would affect the third decimal place of the annuity, so that the annuities are in all cases exact to the third decimal place. The irregularities in the differences, as seen in the column headed Δ , arise from the last figure in the value of the annuity being increased by unity when the next succeeding figure was 5 or greater than 5. These irregularities would of course disappear if the values were given to four decimal places; but besides the increased labour of forming the table in that case, the process of interpolation for intermediate rates would then be much more troublesome, so that it is thought the table in the form here given will be quite sufficient for practical purposes.

It may be noticed, that the value of the life interest, in terms of the premium of insurance, may be found by using *inversely* Orchard's Tables, which give the annual premium in terms of the annuity. Thus, in the table corresponding to 5 per cent interest, to the annuity 8·040 corresponds the premium £6·300, consistently with the result as seen in the subjoined table. That this ought to be the case is apparent, when we remember that Mr. Orchard has

tabulated the function $\frac{1}{1+a_m} - d$. Putting this equal to p , and solving for a_m , we have $a_m = \frac{1}{p+d} - 1$, which is the quantity

tabulated below. It is true, that in Mr. Orchard's tables p and a_m have meanings attached to them different to those we now assign, but the relation between the quantities is just the same. It will not, however, be found convenient in practice to use Mr. Orchard's tables for this purpose. These remarks sufficiently explain the object of the subjoined table.

Table showing the Value of a Life Interest, so as to allow the Purchaser 5 per cent on the outlay, for different values of the Premium of Insurance.

Premium to insure £100.	Value of Life Interest.	Δ.	Premium to insure £100.	Value of Life Interest.	Δ.
£ s. d.			£ s. d.		
1 10 0	14·970	127	3 6 0	11·404	76
1 11 0	14·843	124	3 7 0	11·328	76
1 12 0	14·719	123	3 8 0	11·252	75
1 13 0	14·596	121	3 9 0	11·177	73
1 14 0	14·475	118	3 10 0	11·104	73
1 15 0	14·357	118			
			3 11 0	11·031	72
1 16 0	14·239	115	3 12 0	10·959	71
1 17 0	14·124	113	3 13 0	10·888	70
1 18 0	14·011	112	3 14 0	10·818	70
1 19 0	13·899	110	3 15 0	10·748	68
2 0 0	13·789	109			
			3 16 0	10·680	68
2 1 0	13·680	107	3 17 0	10·612	67
2 2 0	13·573	105	3 18 0	10·545	66
2 3 0	13·468	104	3 19 0	10·479	66
2 4 0	13·364	103	4 0 0	10·413	65
2 5 0	13·261	101			
			4 1 0	10·348	64
2 6 0	13·160	99	4 2 0	10·284	63
2 7 0	13·061	98	4 3 0	10·221	63
2 8 0	12·963	97	4 4 0	10·158	62
2 9 0	12·866	96	4 5 0	10·096	61
2 10 0	12·770	94			
			4 6 0	10·035	60
2 11 0	12·676	93	4 7 0	9·975	60
2 12 0	12·583	91	4 8 0	9·915	59
2 13 0	12·492	91	4 9 0	9·856	59
2 14 0	12·401	89	4 10 0	9·797	58
2 15 0	12·312	88			
			4 11 0	9·739	57
2 16 0	12·224	87	4 12 0	9·682	57
2 17 0	12·137	85	4 13 0	9·625	56
2 18 0	12·052	85	4 14 0	9·569	56
2 19 0	11·967	84	4 15 0	9·513	55
3 0 0	11·883	82			
			4 16 0	9·458	54
3 1 0	11·801	82	4 17 0	9·404	54
3 2 0	11·719	80	4 18 0	9·350	53
3 3 0	11·639	79	4 19 0	9·297	53
3 4 0	11·560	79	5 0 0	9·244	52
3 5 0	11·481	77			

Table showing the Value of a Life Interest—continued.

Premium to insure £100.			Value of Life Interest.	Δ.	Premium to insure £100.			Value of Life Interest.	Δ.
£	s.	d.			£	s.	d.		
5	1	0	9.192	52	6	11	0	7.840	39
5	2	0	9.140	51	6	12	0	7.801	38
5	3	0	9.089	51	6	13	0	7.763	38
5	4	0	9.038	50	6	14	0	7.725	38
5	5	0	8.988	50	6	15	0	7.687	38
5	6	0	8.938	49	6	16	0	7.649	37
5	7	0	8.889	48	6	17	0	7.612	37
5	8	0	8.841	49	6	18	0	7.575	37
5	9	0	8.792	47	6	19	0	7.538	36
5	10	0	8.745	47	7	0	0	7.502	36
5	11	0	8.698	47	7	1	0	7.466	36
5	12	0	8.651	47	7	2	0	7.430	35
5	13	0	8.604	46	7	3	0	7.395	35
5	14	0	8.558	45	7	4	0	7.360	35
5	15	0	8.513	45	7	5	0	7.325	34
5	16	0	8.468	45	7	6	0	7.291	35
5	17	0	8.423	44	7	7	0	7.256	34
5	18	0	8.379	44	7	8	0	7.222	33
5	19	0	8.335	43	7	9	0	7.189	34
6	0	0	8.292	43	7	10	0	7.155	33
6	1	0	8.249	43	7	11	0	7.122	33
6	2	0	8.206	42	7	12	0	7.089	32
6	3	0	8.164	41	7	13	0	7.057	33
6	4	0	8.123	42	7	14	0	7.024	32
6	5	0	8.081	41	7	15	0	6.992	31
6	6	0	8.040	41	7	16	0	6.961	32
6	7	0	7.999	40	7	17	0	6.929	31
6	8	0	7.959	40	7	18	0	6.898	31
6	9	0	7.919	40	7	19	0	6.867	31
6	10	0	7.879	39	8	0	0	6.836	—

On the Calculus of Finite Differences, and its Application to Problems in the Doctrine of Compound Interest and Certain Annuities. By WILLIAM CURTIS OTTER, F.R.A.S.*

(Continued from p. 340, vol. vii.)

THE idea of periodic or discontinuous functions was primitively introduced by Euler, and has since been the subject of extended investigation by M. Fourier, who has made some new and important applications of it in his mathematical theory of heat.

* Our attention has been called, by Mr. Benjamin F. Stevens, Secretary of the New England Mutual Life Insurance Company, at Boston, U.S., to the fact that the substance

It is the nature of those periodic or discontinuous functions, to preserve the same value for an infinite series of values of the corresponding variables subjected to a certain law, and which must be necessarily added to the integrals of the equations of finite differences in order to render them sufficiently general, as simple arbitrary constants are added to all quadratures in order to complete their generality.

Having thus briefly described the nature of periodic functions, I shall now proceed to demonstrate, by a plan similar to that adopted by J. F. W. Herschell, A.M., &c., which is the best that has come under my notice, some of the most important theorems in connection with the subject under consideration.

1. *To find an analytical function of x , such that, by giving to x all integer values from 0 to infinity, it shall give, in regular periodic rotation, the n values, $a, b, c \dots k, a, b, c \dots k$, &c.*

Let S_x represent a function of x which = 1, when $x=0, n$, or a multiple of n , but which vanishes in every other case. Then, if $\alpha, \beta, \gamma \dots \nu$, be the n th roots of unity, $S_x = \frac{\alpha^x + \beta^x + \gamma^x + \dots \nu^x}{n}$; hence it is evident that the function required is

$$P_x = a.S_x + b.S_{x-n} + \dots k.S_{x-n+1}.$$

Now, some one of the values $x, x-1, x-2 \dots x-n+1$, must necessarily be such a multiple; and x being made to vary from zero to infinity, such multiple will be either $x, x-1, x-2 \dots$ or $x-n+1$; in periodic order, therefore, the function P_x will become $a, b, c \dots k$ in the same succession, and which is, therefore, the function sought.

Obs.—The roots of unity on which the above method is based are of great use in analysis, and possess many remarkable properties, as may be seen on reference to works on the theory of equations. The method by which they are obtained rests entirely on this—that the exponential a^x undergoes the extraction of the n th root by substituting $\frac{x}{n}$ in lieu of n ; that every integral value of m makes $\cos. 2m\pi + \sqrt{-1} \cdot \sin. 2m\pi = 1$; that this expression is of the form a^x , being $\epsilon^{2m\pi\sqrt{-1}}$; and that, consequently, one of the n th

of the introductory portion of the paper of which this is a continuation has already appeared in a translation of M. Auguste Comte's work, entitled *Cours de Philosophie Positive*, made by Professor Gillespie, of Union College, in the State of New York. We have, accordingly, pointed this out to Mr. Otter, and that gentleman states that it was fully his intention to have made the acknowledgment due under such circumstances, and that his not having done it was accidental.—ED. A. M.

roots of unity is obtained by writing $\frac{2m\pi}{n}$ for $2m\pi$ in that expression.

Every integral power of an n th root is also an n th root; for, let $a^n=1$, then $(a^m)^n=(a^n)^m=(1)^m=1$, or a^m is an n th root of unity; therefore, a being one root, $a^2, a^3, a^4 \dots (a^n=1)$ are roots also.

2. To find a function, P_x , which shall give the same values, in regular periodic succession, as those of n other given functions, $a_x, b_x \dots k_x$.

Since, by theorem 1,

$$P_x = a.S_x + b.S_{x-1} + \dots k.S_{x-n+1}$$

generates the values $a, b, c \dots k$, by taking x successively $=0, 1, 2 \dots (n-1), (n), (n+1)$, it follows that the function that generates the values $\frac{a_x}{n}, \frac{b_x}{n} \dots \frac{k_x}{n}$, by giving x the successive values $0, 1, 2 \dots n, n+1$, must be

$$P_x = a_x.S_x + b_x.S_{x-1} + c_x.S_{x-2} + \dots k_x.S_{x-n+1}.$$

Def.—These functions are denominated *circulating functions* of the n th order, and may be composed of constant or variable coefficients, as above instanced.

From the above equation, it is evident that

$$f(P_x) = f(a_x.S_x) + f(b_x.S_{x-1}) + f(c_x.S_{x-2}) + \dots f(k_x.S_{x-n+1});$$

i.e., any function of a circulating function is a circulating function whose coefficients are similar functions of those of the original ones respectively.

Also, if Q_x, R_x , &c., represent other circulating functions, we have

$$f(P_x.Q_x.R_x \dots) = f(a_x.a'_x \dots) S_x + f(b_x.b'_x \dots) S_{x-1} + \dots f(k_x.k'_x \dots) S_{x-n+1}.$$

For instance, if the coefficients be constant, we have

$$\frac{P_x + P'_x}{1 - P_x P'_x} = \frac{a + a'}{1 - aa'} S_x + \frac{b + b'}{1 - bb'} S_{x-1} + \dots \&c.$$

Obs.—Care must be taken not to generalize these equations, for $f(P_x.Q_x \dots)$ is itself a circulating function which passes through the cycle of values,

$$f(a_x.a'_x \dots), f(b_x.b'_x \dots) \dots \&c.$$

3. Circulating functions may be doubled, trebled, &c., in order, by assuming new circulating functions with doubled, trebled, &c., cycles of values. Ex. gr.:

$$3_x \cdot a + 3_{x-1} \cdot b + 3_{x-2} \cdot c =$$

$$6_x \cdot a + 6_{x-1} \cdot b + 6_{x-2} \cdot c + 6_{x-3} \cdot a + 6_{x-4} \cdot b + 6_{x-5} \cdot c.$$

This is, I think, too evident to require a formal demonstration.

4. *Any symmetrical function of $S_x, S_{x-1} \dots S_{x-n+1}$ is invariable*:—for, when x varies from 0 to ∞ , some one of the values of these expressions must be *unity* and the other zero; and, as the function is symmetrical, it is immaterial in what order these values occur. The function has, therefore, the same value whichever of its elements become unity, the rest being *all* zero; *i.e.*,

$$S_x + S_{x-1} + S_{x-2} + \dots S_{x-n+1} = 1.$$

$$S_x \cdot S_{x-1} \cdot S_{x-2} \dots S_{x-n+1} = 0.$$

5. *In like manner every symmetrical function of the circulating functions $P_x, P_{x-1}, \dots P_{x-n+1}$ is invariable, provided the coefficients of $P_x, P_{x-1}, \&c.$, be constant*:—for every such function is a symmetrical function of $S_x, S_{x-1} \dots S_{x-n+1}$, as will be seen on considering the properties of the roots of unity demonstrated in books on the theory of equations, by reason of which we have $S_{x-n} = S_x, S_{x-n-1} = S_{x-1}, \&c.$

$$\therefore P_x = a \cdot S_x + b \cdot S_{x-1} + \dots k \cdot S_{x-n+1},$$

$$P_{x-1} = k \cdot S_x + a \cdot S_{x-1} + b \cdot S_{x-2} \dots j \cdot S_{x-n+1},$$

$$P_{x-2} = j \cdot S_x + k \cdot S_{x-1} + a \cdot S_{x-2} \dots i \cdot S_{x-n+1},$$

$$\vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots$$

$$P_{x-n+1} = b \cdot S_x + c \cdot S_{x-1} + \dots a \cdot S_{x-n+1}.$$

Hence, it is evident that any symmetrical function of the right-hand members of these equations will involve $S_x, S_{x-1} \dots S_{x-n+1}$ symmetrically, and will, consequently, be invariable. Its value will also be equal to that of a function whose coefficients are $a, b, c, \&c.$ For instance, if

$$P_x = a \cdot S_x + b \cdot S_{x-1}, \text{ where } n=2,$$

$$P_{x-1} = a \cdot S_{x-1} + b \cdot S_x;$$

$$\therefore P_x \cdot P_{x-1} = (a \cdot S_x + b \cdot S_{x-1}) (a \cdot S_{x-1} + b \cdot S_x) \\ = ab \cdot S_x^2 + ab \cdot S_{x-1}^2 = ab \cdot (S_x^2 + S_{x-1}^2) = ab,$$

an *invariable* quantity; since, by theorem 4,

$$S_x + S_{x-1} + \dots S_{x-n+1} = 1,$$

$$\text{and } S_x \cdot S_{x-1} \cdot \dots S_{x-n+1} = 0;$$

and, generally,

$$P_x \cdot P_{x-1} \cdot P_{x-2} \dots P_{x-n+1} = a \cdot b \cdot c \dots k;$$

$$P_x + P_{x-1} + P_{x-2} + \dots P_{x-n+1} = a + b + c + \dots k.$$

Obs.—I have before stated that circulating functions may be doubled, trebled, &c., by assuming new circulating functions with

doubled, trebled, &c., cycles of values; hence we have an easy method of reducing two or more circulating functions, with different periods of circulation, to a common period. *Ex. gr.:* If

$$P_x = a.S_x + b.S_{x-1}, \text{ where } n=2,$$

$$P'_x = \alpha.S_x + \beta.S_{x-1} + \gamma.S_{x-2}, \text{ where } n=3,$$

we have, by trebling the first and doubling the second,

$$P_x = a.S_x + b.S_{x-1} + a.S_{x-2} + b.S_{x-3} + a.S_{x-4} + b.S_{x-5},$$

$$P'_x = \alpha.S_x + \beta.S_{x-1} + \gamma.S_{x-2} + \alpha.S_{x-3} + \beta.S_{x-4} + \gamma.S_{x-5},$$

which are both reduced to the common period of *six*.

The reason of the above process is obvious, for, when either x , $x-2$, or $x-4$, is a multiple of 6, it is also a multiple of 2, \therefore both functions reduce themselves to a ; also, if $x-1$, $x-3$, or $x-5$, be a multiple of 6, and consequently of 2, $x-1$ must necessarily be a multiple of 2, in which case they both reduce themselves to b ; and, generally, it may be shown that if

$$P_x = a.S_x + b.S_{x-1} + \dots + k.S_{x-n+1}$$

$${}_1P_x = a_1.S_x + b_1.S_{x-1} + \dots + k_1.S_{x-n_1+1}$$

$$\vdots$$

$${}_pP_x = a_p.S_x + b_p.S_{x-1} + \dots + k_p.S_{x-n_p+1},$$

we have

$$P_x = (a.S_x + b.S_{x-1} + \dots + k.S_{x-n+1}) + (a.S_{x-n} + b.S_{x-n-1} + \dots + k.S_{x-2n+1}) + \&c.,$$

to $n_1.n_2.n_3 \dots n_p$ terms,

$${}_1P_x = (a_1.S_x + b_1.S_{x-1} + \dots + k_1.S_{x-n_1+1}) + (a_1.S_{x-n_1} + b_1.S_{x-n_1-1} + \dots + k_1.S_{x-2n_1+1}) + \&c.,$$

to $n_1.n_2.n_3 \dots n_p$ terms,

$$\vdots$$

$$\vdots$$

$$\vdots$$

$$\vdots$$

$${}_pP_x = (a_p.S_x + b_p.S_{x-1} + \dots + k_p.S_{x-n_p+1}) + (a_p.S_{x-n_p} + b_p.S_{x-n_p-1} + \dots + k_p.S_{x-2n_p+1}) + \&c.,$$

to $n_1.n_2 \dots n_{p-1}$ terms;

by which means the equations are all reduced to the common period of $n.n_1.n_2 \dots n_p$.

Hence the following general rule for the reduction of circulating equations with different periods to a common period:—

Find the common measure of the separate periods, should they have one; then the continued product of all the periods, divided by this common measure, will give the common period sought.

From this it is obvious that, should equations occur involving circulating functions with different periods of circulation, they may be integrated, some instances of which will be given hereafter. It would be out of place to give them here, as I must first say something about circulating equations, the nature of which is such that

their coefficients are circulating functions, and to resolve them it is clear that they must be reduced to equations of the ordinary kind, and one of the most important objects of the preceding theorems is to show how this may be best effected.

The following is a simple instance of a circulating equation—

$$u_{x+2} \pm P_x \cdot u_{x+1} \pm u_x = 0,$$

in which P_x is a circulating function of the second degree, or in which $n=2$ and $P_x = a.S_x + \beta.S_{x-1}$.

Now there are various ways of solving such an equation as this, but the following, by J. F. W. Herschell, A.M., &c., is one of the most simple:—

$$\text{Let } u_x = v_x \sqrt{P_x},$$

$$\text{then } u_{x+2} = v_{x+2} \sqrt{P_{x+2}} = v_{x+2} \sqrt{P_x},$$

by theorem 5; hence, by substitution, we have

$$v_{x+2} \sqrt{P_x} \pm P_x \cdot v_{x+1} \sqrt{P_{x+1}} \pm v_x \sqrt{P} = 0;$$

$$\text{or, } v_{x+2} \pm v_{x+1} \sqrt{P_x \cdot P_{x-1}} \pm v_x = 0;$$

but, by theorem 5, the functional product $P_x \cdot P_{x-1}$ is *invariable* and $= a.b$; \therefore our equation becomes

$$v_{x+2} \pm \sqrt{ab} \cdot v_{x+1} \pm v_x = 0,$$

being an ordinary equation with constant coefficients, and easily integrated by the usual methods.

Obs.—In the next Number of the *Journal*, I hope to give a more general process of solving such equations as these, by assuming for the independent variables a circulating function with unknown and variable coefficients, which will be found to apply to all kinds of circulating equations, together with a method of integrating equations involving circulating functions with different periods of circulation, with the application of the preceding theorems to some useful and interesting questions in the doctrine of compound interest annuities, continued fractions, &c., &c.

Forms of Endorsement on Policies used in the Practice of Life Assurance.

AS the forms above referred to are now numerous, and in constant requisition, we have thought that, by collecting some of them together and putting them into print, we might be affording certain facilities for, and leading the way to, more uniformity of practice in this particular than has hitherto been attainable. We, accord-

ingly, append such specimens as we have been able to get together, and shall be obliged to any of our readers who will afford us the means of adding to their number, or who will suggest any improvements in their construction. Most of those now given have been in use for many years amongst some of the older Companies. It is quite possible that amongst those of more recent date better forms are rife, and we shall be very glad if the publication of these prove the means of bringing such to light.—ED. A. M.

FORM OF ENDORSEMENT FOR CONVERTING A TERM POLICY INTO ONE FOR AN ENDOWMENT ASSURANCE.

In consideration of the (annual, half-yearly, or quarterly) payment of the within-mentioned premium, and a due fulfilment of all the other conditions of this policy, it is hereby agreed that, in the event of the saidsurviving the term of.....years, the sum assured shall be payable to him (the assured, his executors, administrators, or assigns) or his assigns at the expiration of three calendar months after the.....day of....., which shall be in the year 185...., should the same not have been previously claimed under the provisions within recited.

FOR ALLOWING A PORTION OF THE PREMIUM TO REMAIN ON CREDIT.

It is hereby agreed that the within assurance shall be and remain in full force on payment of two thirds of the annual premium of £..... within mentioned, the other one third remaining at 5 per cent. interest, as a charge upon the sum assured, to be deducted (if not previously paid up) when the said sum shall become payable: Provided always that the interest due on such amount as may be in arrear be paid annually, and, during the first five years, in advance: Provided also that the amount in arrear never exceed five thirds of the annual premium, that is to say £..... In accordance with this agreement, the said assured hath paid the sum of £....., and £.....interest, in lieu of the annual premium of £.....within mentioned.

FOR ALTERATION FROM ANNUAL TO HALF-YEARLY OR QUARTERLY PAYMENTS.

It is hereby agreed that, in lieu of the annual premium within mentioned, a half-yearly (or quarterly) premium of £.....shall be payable in respect of this policy on the.....day of.....in this year, and on the.....day of.....and the.....day of.....in each and every succeeding year during its continuance, the within-named.....having paid the sum of £.....as the premium on this policy to the.....day of....., 185...., in lieu of the sum of £.....herein mentioned.

FOR ALTERATION IN DATE OF PAYMENT.

In consideration of the payment made this day of the sum of £....., the receipt whereof is hereby acknowledged, it is hereby agreed that this

assurance shall remain in full force until the.....day of.....next inclusive, and that the annual (half-yearly or quarterly) premium within mentioned of £.....shall in future be payable on the.....day of.....in each year, anything within contained to the contrary notwithstanding.

FOR ALTERATION, FROM A NON-PARTICIPATING POLICY TO A PARTICIPATING ONE.

In consideration of the said.....having this day paid the sum of £....., the receipt whereof is hereby acknowledged, and agreeing to pay the like sum annually, during the continuance of the within-written policy, on the.....day of....., instead of the sum of £.....within stated, it is hereby agreed that the assured shall henceforth be entitled to participate in the future profits of this Company.

FOR CORRECTING ERRORS IN AGE AND CHRISTIAN NAME CONJOINTLY.

Satisfactory evidence having been produced that the within-namedwas in his.....year at the date of this assurance, instead of in his....., as stated in the proposal, it is hereby agreed that this policy shall be, and remain, in full force on payment now of the sum of £....., and on payment in future of the annual premium of £....., instead of £.....herein stipulated for; and it is hereby admitted that the age is now correctly stated, and that the proper designation of the within-named.....is....., evidence having also been produced to that effect.

FOR CORRECTING AN ERROR IN THE CHRISTIAN NAME.

Evidence having been produced that the within-named.....was baptized as....., and not as....., it is hereby admitted that his proper designation is.....accordingly.

FOR LICENCE TO PROCEED AND TO RESIDE BEYOND THE USUAL LIMITS.

In consideration of the payment this day of £....., the receipt whereof is hereby acknowledged, and of an additional annual payment of £....., to be made on the.....day of.....in this and the following years, so long as this licence may be required, it is hereby agreed that the within-named.....shall have leave to proceed to....., reside there, and return to Europe, anything within contained to the contrary notwithstanding.

FOR LICENCE TO SERVE AS A MARINER.

In consideration of the payment this day of £....., the receipt whereof is hereby acknowledged, and of an additional annual payment of £....., to be made on the.....day of.....in this and the following years, so long as this licence may be required, it is hereby agreed that the within-namedshall have leave to follow the occupation of master mariner, anything within contained to the contrary notwithstanding.

FOR PROTECTION OF THE ASSURED WHEN THE LIFE ASSURED PROCEEDS
BEYOND LIMITS WITHOUT HIS KNOWLEDGE.

It is hereby agreed that, should the within-named.....go, without licence, beyond the limits prescribed by this policy, this assurance shall, nevertheless, remain in full force and effect, provided the assured or his representatives shall, within fourteen days of such event coming to his knowledge, pay the additional premium usually required for the risk incurred.

FOR TRANSFER OF A POLICY FROM ONE COMPANY TO ANOTHER.

In consideration of the within-named.....agreeing to the transfer of this policy to the.....Insurance Company, to pay to that Company all future premiums as they become due, and to observe and perform all the stipulations contained therein on his part, we do hereby agree to observe and perform all the stipulations contained therein on the part of the.....Company.

Before the reduction took place in the rate of duty charged by the Government on life policies, it was very generally the practice, amongst Offices effecting reassurances, to accept, instead of the usual policy, an endorsement on a copy of the original one. Since the reduction, however, the practice has, we believe, been for the most part abandoned, and policies are now almost universally issued whether the assurance be made on behalf of an individual or of a Company. The endorsement system was attended with certain advantages—amongst others with that of establishing a complete identity in the risk to which each Company was liable. The same thing, however, is now pretty well effected by merely referring in the declaration to the papers connected with the original proposition, no fresh matter being introduced; and the two contracts are thus made to stand upon very nearly the like footing, whilst a proper uniformity is, at the same time, preserved in official practice.

On the Progress of Fire Insurance in Great Britain, as compared with other Countries. By SAMUEL BROWN, F.S.S.

(Concluded from p. 349, vol. vii.)

X.—*Fire Insurance in America.*

THE returns of the various Insurance Companies are published in some of the United States, so that if all the facts were fully stated as required, a fair estimate could be formed of the extension of the business of the Companies from year to year, with their premiums, capital, reserve, &c. Those of the commonwealth of

Massachusetts are given agreeably to the requirements of Acts passed in 1837 and 1842. In 1850, the requirement of returns from the mutual Fire Insurance Companies was repealed by an Act of May 3rd in that year.

In 14 out of 18 Companies in Boston, the returns on 1st December, 1850, showed at risk against fire—

	1st December, 1850. Sums Insured.		1851.
	£		£
	12,275,350	(14)	12,150,619
And in four (out of 12) Offices } out of Boston . . .	513,505	(5)	1,599,205
	<hr/>		<hr/>
	12,788,655		13,749,824
In two mutual Companies .	1,506,972	(4)	2,004,615
	<hr/>		<hr/>
Total . . .	14,295,627		15,754,439

The above appear to be only the insurances remaining in force at the end of the year, and not to include the current risks of the year; and the premiums and losses are not sufficiently definite to allow of comparison. But other returns show, that in the two mutual Companies, of which the amount of risk at the end of the year was £1,506,972, the new business of the year was £2,598,449, the premiums on which were £7,810, being an average of 3s. or 6s. per cent., and the losses about 50 per cent. on the premium.

In 1851, the amount insured in the share Offices had increased from £12,788,655 to £13,749,824. From the amount insured in the year in four Companies, £3,683,079, the premiums on which were £10,858, the average rate would seem to be almost exactly the same as last year.

In the State of New York, the returns made by the Comptroller of the State for the year 1851, the amount of assurances are stated in 30 Companies to be £48,954,660—four Companies not giving the return. The premiums for the year are only stated for 18 Companies, and amount to £195,814; and the losses for 33 Companies (one only being deficient) at a total of £243,339. But some of the premiums include interest and income, and many of the statements of losses include expenses of carrying on the Companies, so that no satisfactory percentage of either can be deduced from these items.

From the *United States Insurance Gazette* for January last, it appears that in the year 1855 there were in the State of New York 69 Joint-stock Fire Insurance Companies, with an aggregate cash capital of about £2,770,400; and the following shows a comparison

of the two years 1854 and 1855, including mutual Companies, and Companies of other States doing business in the State of New York :

	Sums at Risk.	Premiums.	Losses Paid.
	£	£	£
1854....	152,389,283	1,366,328	..
1855....	101,380,596	1,377,688	568,159

The business appears to have diminished during the past year, owing, it is said, to the want of confidence arising from the failure of some Companies, and the investigation to which others had been legally subjected by the Government officers appointed for that purpose.

XI.—*General Summary.*

With the exception of Great Britain and France, the preceding returns must be very defective ; they indicate a large amount of property insured against fire, and in some degree illustrate the progress of the business ; but in each of the countries named, a vast amount carried on by Government, or by local Companies, must have escaped notice. It will be interesting, however, to bring all the returns I have actually given down to the close of last year, by approximating, as near as possible, by estimates made at the rate of progress last observed. (*See Table, next page.*)

From this rough approximation it appears, that the total of the amount of fire insurances in the countries, or in the Offices referred to in the preceding pages, and estimated to the present date, amounts to the large sum of 4,482½ millions sterling, though it is evident that it by no means gives an adequate view of the total amount of property insured against fire in Europe and America. A vast amount, protected by Governments or private Associations, must still have escaped notice. The annual premiums on the whole amount may be not far short of £8,200,000, and the losses per annum about £4,773,000.

XII.—*Fire Insurance Duty in Great Britain.*

The statements which have been given above, relative to fire insurances in foreign countries, are no doubt very defective, because the returns from the Companies are not required on any uniform plan, and a large amount is probably insured in private Associations of which no account is taken. The percentage duty in Great Britain, however, allows of a much nearer approximation being made to the actual amount of insurance in this country, exclusive

	Sums Insured against Fire, estimated at the end of 1856.		Premiums, estimated as nearly as possible from previous Averages.	Losses estimated.
	£	£	£	£
<i>Great Britain</i> (deduced from the duty)	927,000,000		..	..
Farming stock exempt	70,000,000		..	..
Foreign and colonial business, about	125,000,000			
		1,122,000,000	1,953,000	976,500
<i>France</i> , proprietary Companies ..	1,320,000,000			
Mutual Companies	480,000,000			
		1,800,000,000	1,566,000	774,000
<i>Germany</i> , including Austria (as- suming the rate of increase for the last three years to be the same as in 1853)	700,000,000		1,624,000	812,000
Government insurances and foreign Insurance Compa- nies, &c., about	450,000,000		1,125,000	1,125,000
(Premium tax about '250 per cent.)		1,150,000,000		
<i>Belgium</i> , ten Companies (assume increase 2 per cent. per an- num since 1850) .....	..	138,000,000	144,900	63,500
<i>Sweden</i> , four Companies (at same rate of increase as 1845 to 1850; premiums at double the losses) .....	..	11,800,000	53,100	26,500
<i>Denmark</i> , Government insurance (assume increase at 2 per cent. per annum since 1844, premiums being a tax = losses)	29,000,000		54,300	54,300
Company at Copenhagen	3,800,000		16,700	4,400
Another Company (premium and losses doubtful, assumed at about half the preceding) ...	6,900,000		15,000	4,100
		39,700,000		
<i>Russia</i> , Company at St. Peters- burg (sum insured not given; but, in 1852, the accounts state the police tax due as £21,648, which, if for a year, would give about £29,000,000 insured in 1852) say .....	..	30,000,000	140,000	52,000
<i>Poland</i> , Government insurance of buildings (premium taxes = losses) .....	..	16,000,000	86,000	86,000
<i>America</i> , Boston Offices (assum- ing same rate of increase as in 1851)	23,000,000		69,000	34,500
New York Offices (business fell off in 1855, assumed same as in 1854)	152,000,000		1,370,000	760,000
		175,000,000		
Total		4,482,500,000	8,217,000	4,772,800

of what may be effected by British Companies abroad. But this tax has, almost since it was first levied, met with reprobation as a tax on prudence, a heavy discouragement to the extension of the business; and even if it could be admitted to be just and moral to tax the exercise of prudence more heavily than self-indulgence, it is so disproportioned to the average taxation on other objects, that general surprise has been excited at the defence of it by the Chancellor of the Exchequer, and by Mr. Coode's report, from which his arguments were drawn. Even so far back as 1806, Sir Frederick Eden, in his valuable little work, *On the policy and expediency of granting Insurance Charters*, denounces the heavy burden which it imposed on the business of fire insurance, when the tax was only 2s. 6d. per cent. on the sum insured, pointing out that, at the ordinary premium for brick buildings (2s. per cent.), the tax was even then 125 per cent. on the value of the risk. Tobacco, sugar, and wine, he adds, are among the few articles which can vie with insurance in contributing so largely to the revenue, in proportion to their value, and none possess the further excellence of being paid into the revenue at the expense of only 5 per cent. of their gross produce. In 1815, when the war taxation began to be gradually diminished on articles even of needless luxury, this tax was increased by 20 per cent., being raised in that year from 2s. 6d. to 3s. per cent., and notwithstanding the feeling of the public, strongly expressed on many occasions, appeals to the finance minister, petitions from Insurance Offices, merchants, bankers, and many other classes interested in its removal, it continues to be a heavy clog on the progress of insurance; and, from the recent declaration in the House of Commons, threatens to be maintained perpetually at its present high rate, unless the public will stir themselves for its reduction, even if deterred by the necessities of the state from advocating its entire removal.

As it is evident that the defence of the Government rests mainly on Mr. Coode's report, we shall be better able to consider the bearings of the question by examining and replying to some of his principal statements and arguments.

Mr. Coode contends that the duty is light, because it bears a very small proportion to the value of the property insured; that in ordinary cases, where the property is fully insured, it does not exceed 1 to 667 of the value, and that even this would give a very exaggerated notion of the actual burden, because no house is wholly indestructible, and that by constant improvement in the construction, by increase of party walls, &c., the amount of incombustible ma-

terials is constantly increasing. He considers that the practice of insuring one third to two thirds of appraised value, effectually covers the risk incurred; and the tax consequently diminishes from 1 in 1,000 to 1 in 2,000, in proportion as two thirds, one half, or one third of the value is insured. But it must be observed, that though a portion of the property may be incombustible, it does not follow that it must be unⁱⁿsurable; for even iron and stone may be so injured by the effects of fire as to be practically useless for the reconstruction of a building; and the duty would probably fall on a considerable part of the value now uninsured, if the amount of it were not so oppressive as to force the owner to be his own insurer. But even if this were not the case, the question is not, whether the tax is heavy upon property, but whether it is heavy on the cost of insurance? In the same manner as Mr. Coode argues that it becomes light upon the owners of house property, in proportion as they leave a large portion uninsured, he endeavours to convince us that it falls lightly upon the consumers of commodities, because the insurance of stock in trade, handicrafts, and manufactures, covers successive portions of stock, and consequently represents values greater in proportion as the stock is frequently changed. Thus, fishmongers, who keep one day's consumption—butchers, two or three days'—bakers, a week's—grocers, three weeks'—wine and spirit merchants, a month's—and the wholesale trader, from a few days' to three months'—would actually pay duty only on proportionate values, varying from 300 times to 4 times the sum insured, or from the fishmongers, paying about the $\frac{1}{200000}$ th part, to the cotton merchants, paying about the $\frac{1}{3000}$ th part of the value in duty. Now it is clear, that all the duty on the intermediate transfers of consumable commodities will have to be paid eventually by the consumer, who, though he may find the increase of price only slightly affected by the duty, may have just cause of complaint that it should be affected at all, when it is an addition laid on by the Government for what he naturally has to pay for the non-destruction by fire of the value of these various articles of provision or use before they reach his hands. The truth is, that Mr. Coode, in this part of his argument, loses sight of the tax as a fire insurance tax, and converts it into an indirect property tax, chargeable upon the owners or consumers of property who have preserved its value from destruction by fire by an insurance against this risk. But why should these prudent possessors of property be the only sufferers by the tax, and the possessors of uninsured property escape? Why should the owners of incombustible or uninsurable property, such as land, the

funds, share property, or cash in hand, be placed out of the chance altogether of having to contribute to a tax, which, it is evidently argued, falls lightly only because it is a small tax on the value of property? It should be remembered too, that the tax so levied falls for the most part on buildings, and on articles of consumption or use from which the profits of trade are created, and which, consequently, are already subject to a direct income or property tax. Although the fire insurance duty, in this point of view, has never participated in the reductions which have been forced upon the Government in the other direct taxes, yet the proceeds amount to the by no means contemptible sum of £1,340,000, and form nearly a fourth part of what the whole income tax amounted to when it was at 7*d.* in the pound.

But reverting to the duty as a tax, which it really professes to be, a tax upon insurance, Mr. Coode contends, instead of being 200 per cent. upon the premium, as unfairly represented in the complaints made against it, that as the premiums vary from 1*s.* 6*d.* per cent. for private houses of the best class to 4*s.* for agricultural stock, 12*s.* for warehouses, 5 guineas for theatres, &c., the average, as deduced from the returns of a large Insurance Company, would be not less than 3*s.* per cent., and the duty consequently varies from 200 to 3 per cent. on the premiums, and is only 100 per cent. on the average Office value of the risk. He considers that, as the duty remains fixed, it presents a happy adjustment of the burden to the means of those who can bear it, being comparatively heavy where the property is most valuable and subjected naturally to the least cost of insurance, and comparatively light as the property is most precarious and subject to the greatest burden in the cost of provision against fire. In this case, the question of the duty being a property tax again comes into view; for it is only by assuming that the property is estimated to be more valuable in proportion to the smallness of the premium, that the argument is of any effect. In any other sense, it would seem strange, that if the premiums of insurance can be taken as the value of the benefit which the insured derives, a tax of 200 per cent. should be laid upon one individual, because he is the owner of a house, and of only 3 per cent. upon another, because he is the owner of a theatre. The premiums, after all, are only the previous savings of a number of individuals to meet a loss by fire when it comes; and, if the premiums received may be assumed to represent the actual loss incurred, the effect of the tax is, that whenever a private house worth £1,000 is destroyed by fire, the owner has to pay £1,000 to reinstate his property, and

£2,000 more to Government for permission to do so; or, since the real value of the risk cannot practically be taken at much more than half the premium, £4,000 to Government for every £1,000 laid out to reconstruct the building. On the other hand, it is true, according to Mr. Coode's arguments, that if he had been the fortunate possessor of a theatre worth £100,000 which had been destroyed by fire, he would only have to pay £3,000 to Government, under similar circumstances, or £6,000 if half the premiums would have met his loss. Is there any tax that can be pointed out more unjust in its principle, or more oppressive in its operation, than this?

Mr. Coode looks upon the objection that these taxes are "taxes on prudence," as merely rhetorical, and contends that it is in the very nature of taxation "to be mainly derived from the exertion of all the moral and physical excellences productive of wealth; for industry, enterprise, fortitude, temperance, prudence, are necessarily the main producers of revenue, both private and public;" that vicious acts do not in general so continuously produce wealth as to allow of any considerable part of any national revenue to be derived from them; and that, in taxing to a considerable extent some stimulants and luxuries, we have probably gone to the full extent that is safe or desirable. No doubt the greater part of the growing wealth of the country, liable or contributing to taxation, must be owing in some degree to the exercise of that provident self-denial that does not spend all that it creates by skill or labour, but lays by something for the future; and if all taxation were to be remitted, except what depended on vice or self-indulgence, a large part of the revenue of the country would have to be sacrificed; but this is overstraining the argument. The insurance duty is a tax upon the preservation from destruction by fire, of property which has been acquired by continued labour and the exercise of all those moral excellences which, it is admitted, are generally needed for the production of wealth—efforts which have been checked and incumbered in their earliest attempts at its creation, and which, in every stage of the progress, had been harassed and pursued by the utmost ingenuity of taxation. When the reward has, after so much toil and so many drawbacks, at last been attained,—when industry, courage, skill, and self-denial have at last succeeded in realizing the hard-earned result, it surely could not be considered unreasonable to expect that the preservation of it might be free to a certain extent from those fiscal burdens from which it has suffered so long, and not be loaded with an extra tax, out of all proportion to those which it has already passed through.

To the objection that the tax, as 200 per cent. upon the ordinary rate of premium, by its oppressiveness, acts virtually to the discouragement of insurance, and that if it were diminished a considerable extension would ensue, producing an equal or increased revenue, Mr. Coode replies by an inquiry into the value of property in England really insurable. It is admitted that, with existing materials, any near approximation to the truth is almost impossible. The large amount of property set down as uninsurable may be correct or not—viz., land and its modifications taken at £50,000,000 a year, at 33 years' purchase = £1,550,000,000; of investments in national and other funds, in roads, railroads, canals, and the like, valued at not less than £1,200,000,000 more; agricultural stock of growing crops, or live stock not in sheds; cash and money in hand or in banks, forming together a very considerable deduction from the amount capable of insurance. Some of these items, however, may be questioned; as a large portion of railway investments, for instance, must consist of business premises, stations, &c., liable to be destroyed by fire; but, in any case, there is reason to believe that he must have considerably underrated what remains.

The principal subjects of fire insurance are stated to be—

1. Houses, warehouses, workshops, and the like erections generally.
2. Household furniture and the ordinary contents.
3. The stock of producers and traders.

In the inquiry as to the value of houses or other buildings, he contends that a large proportion must be indestructible, and therefore uninsurable; and in another very large proportion, especially shops, warehouses, workshops, manufactories, the value depends upon their situation, which is an uninsurable value, and his estimate of the amount to be insured comes out no more than 10 years' purchase of the net rental. Taking the assessment to the property tax of all houses in England and Wales, as returned for the year 1855, he concludes that £436,289,780 is the total insurable value of house property therein; but to make cavil impossible, and to allow beyond all reason for exempted property, for unoccupied buildings, and for the under-estimate of some that are occupied by their owners, he allows 15 years' purchase of the rack rental, making a total for the insurable value of house property in England and Wales of £654,000,000.

As to household furniture, utensils, wearing apparel, and such objects as commonly constitute the contents of dwelling-houses, he

considers the value is relatively on the decrease, from the diminished weight, substance, magnificence, and costliness of household furniture, &c.; and after various inquiries, concludes that it would be to adopt quite the extreme value of exceptional classes to take it at five times the rental of houses, or upon the assessment, as before, of 1855, at £220,000,000.

As to the third subdivision, the insurable value of the stock of producers and traders, after allowing that the amount on the whole must be largely increasing, he contends that the insurable value at any one time is, on the contrary, rapidly diminishing by every improvement in the practices of business, and in the accessibility of markets, both for the raw material and the elaborated products,—the value of stock in hand being diminished, but with the diminished stock a greater aggregate trade done.

He assumes that the ordinary consumption by every family of all articles of trade, may be taken at about equal in value to five times their house rent, and that on an average of all these trades, three months' consumption was always on hand. We should then have $£44,000,000 \times 5 \div 4 = £55,000,000$, as the insurable value of stock in hand on the home trade, and probably as much again for combustible stock in hand of the foreign trade: total £110,000,000. This rateable value has, however, been already more than covered, by assuming five years' rental of the warehouses or shops in which it is deposited, and he concludes that nothing more is to be added for the insurable property of England and Wales, unless the value of the costly machinery in some of our great manufactories should bring the average above the five years' rental, and unless some further considerable sum should be added for shipping and craft, the risks of which from fire are not covered by their marine insurances. He still leaves the whole insurable property of England and Wales in 1855 at no more than £874,000,000. The amount actually insured, and for which duty was paid in that year, was £785,000,000—or rather, if we remember that Mr. Coode's table of duty is made up to the 5th January in each year, the next lower item of £802,574,000 should be the total compared, and no doubt, if the estimate is true, the limit of fire insurance is very nearly reached; no great increase of fire insurance could be expected; and the argument that the produce of the tax might be increased, or at any rate maintained, at its present amount if the present heavy duty were diminished, would fall to the ground. But the estimate is so contrary to the experience of every one conversant with the business, that we cannot but come to the con-

clusion that some great omission has occurred. It is the opinion of some of the most experienced men in the business of fire insurance, that 15 years' purchase of the rental may be a fair average insurable value of the buildings, but that the contents even of private houses have been repeatedly tried, and cannot be taken on an average at less than cent. per cent. on the value of the buildings; in shops at twice this amount; and in wholesale warehouses, at a moderate estimate, at four or five times the same. In 1806, Sir Frederick Eden entered into a most careful computation, under different heads, of all the insurable property of Great Britain, which he made close upon £602,000,000. Leaving out, however, for the purposes of the present comparison, Scotland and Ireland, agricultural stock, which he puts at £37,500,000, and shipping in British ports at £5,250,000, his estimated values for England and Wales may be thus subdivided:—

	£
Houses, warehouses, &c.	200,000,000
Furniture, clothes, &c.	185,000,000
Manufactures, machinery, &c.	99,000,000
Total	£484,000,000

an estimate, the relative proportions of which much more nearly accord with the experience of Insurance Companies than that in the report, which only sets the contents of all kinds, domestic furniture, stock in trade, &c., at one-third of the value of the buildings in which they are contained. Assuming that the increasing trade of the country must largely increase the stocks in hand since 1806, it would probably be a very moderate valuation to reckon the contents, instead of one third, at least half as much again as the value of the buildings, and the estimate would then stand—

	£
Value of buildings	654,000,000
Contents of ditto	981,000,000
Estimate for 1855	1,635,000,000
Insured in 1855	802,574,000

allowing of a considerable margin for the expansion of the business in England and Wales, independent of the considerable increase that might be expected in Scotland and Ireland.

This view of the case is confirmed by the reports of fires in London that occurred in the years 1836 to 1849, when the number of buildings and contents insured and uninsured were compared.

The results will be found in an article on the Fires in London, which I prepared for the *Assurance Magazine* in 1854, vol. i., p. 41.

Proportion per Cent. of Insurances ascertained to have been effected in case of Fire.

	Average of whole Period, 1836 to 1849.	1848 and 1849 only.
Buildings and contents insured	37·58	41·27
Buildings only "	15·24	17·22
Contents only "	14·69	12·54
Neither "	32·49	28·97
	100·00	100·00

As the proportion of insured to uninsured increases throughout all the four periods given in the original table, it will be fair to take the last period only for comparison. Assuming that where £100 is insured on the buildings, there should also be insured £150 on the contents, the table may be read thus:—

	Insured.	Uninsured.
	£	£
Fully assured buildings and contents } (£100 on buildings and £150 on } contents)	10,318	..
Buildings only (contents may be in- } sured), £150 for each £100	1,722	2,583
Contents only (buildings may be in- } sured), £100 for each £150	1,254	836
Neither (both may be insured) £100 } on buildings and £150 on contents. }	..	7,243
Total	13,294	10,662

so that in London (where it may be reasonably supposed the largest proportion of property has been already insured), where £13,294 is already insured, there would, if all the buildings and contents had been fully insured in the like proportion, be a further increase of £10,662, showing a margin of 80 per cent. still to be brought within the benefits of insurance. It strongly confirms the view previously taken, that there is still ample room for the increase of the business on existing property, independent of the yearly added value in the creation of new insurable property.

I may remark here, in respect to Mr. Coode's opinion, that the substance and costliness of household furniture have much diminished, that it may be true as regards palaces and great mansions; but that it must have come within every one's observation,

that the houses of the middling classes, tradesmen and farmers, are much better furnished than formerly. From the large numbers of houses of this description, it is evident that they would more than compensate for the diminished values in the other class. To contend, as Mr. Coode seems to do, that an average insurable value of £41. 7s. for every inhabitant of this country is the limit of insurance, when we have seen that, as far back as 1847, the insurable value in buildings alone to each inhabitant of Baden and Belgium was £20. 17s., gives us but a poor idea of the increasing industry, energy, skill, and prudence, and their natural concomitant wealth, which we are accustomed to glory in as the distinguishing characteristics of our countrymen.

A glance at the last statistical abstract for the United Kingdom will show the surprising advance which has been in every branch of trade during the last 15 years. The total declared value of British and Irish produce has increased from £47,285,000 in 1842, to £115,891,000 in 1856 (=145 per cent.). The total tonnage of British and foreign vessels, entered and cleared with cargoes only at ports in the United Kingdom, has increased from 7,346,804 tons in 1842, to 17,902,998 tons in 1856 (=nearly 144 per cent.), and the capital in the savings' banks from £25,300,000 in 1842 to nearly £35,000,000 in 1856=38·6 per cent.—all evidences, whilst the estimated population has only increased from 16,124,000 to 19,044,000 (=about 18 per cent.), that the average insurable property of each individual must have increased more in proportion than the population in the same time, and far more than the rate at which fire insurance has increased, which Mr. Coode's table only sets at £600,670,000 in 1842, to £802,574,000 in 1856 (=33·6 per cent.).

Mr. Coode further adduces, what he considers proofs, that the tax cannot be shown to have impeded the operation of those causes which tend to the increase of fire insurance. It is, of course, very difficult to prove at what rate fire insurance would have increased, if it had been freed from the burden of the tax. Some of his reasonings, however, depend on the difference in the date of the Act by which the percentage duty was raised from 1s. 6d. to 2s. in 1797, misquoted as 1787; but in other respects also it seems to me that the reasonings are contrary to the facts actually given. Mr. Coode admits that from 1694 to 1782 the business steadily increased, the annual rate of increase being about $2\frac{2}{3}$ millions; that from 1782, when the first percentage duty was laid on, in addition to heavy stamp duties, the amount insured decreased

about £7,000,000 annually, till 1786. From 1787 to 1797 we must correct Mr. Coode's figures, the percentage duty still remaining at 1s. 6d., and stamp duty on policies as before. The increase in this period was, on the average of the 10 years, about £1,900,000 annually over the average of the preceding five years. In the following 10 years, the duty being increased from 1s. 6d. to 2s. per cent., but the policy stamp duty reduced, from 6s. under £1,000 and 11s. for £1,000 and upwards, to 3s. and 6s. respectively, the increase was £6,400,000 annually. In 1804, the percentage duty was increased from 2s. to 2s. 6d., but the policy stamp reduced from 3s. and 6s. to 1s. From 1804 to 1815, the increase on the preceding average was about £105,000,000, or about £9,500,000 annually; it is only when we arrive at 1815 that we find an increase of percentage duty without a reduction of the stamp on policy; and, by Mr. Coode's own table, the amounts insured in the following three years, viz., 1816, 1817, 1818, were respectively less than in 1815 by about £4,500,000, £7,100,000, and £4,300,000, and the year 1820 only exceeded 1815 by £264,000. It would appear, therefore, that if we take in account the remission of the policy stamps, the increase in each period is not what might have been expected from the growing wealth of the country; that in the early stage of its progress, previous to 1782, when the public had to be taught the benefits of insurance, it is not surprising that the rate of increase was not more rapid than £3,000,000 a year, but that an increase in the business, on an average of the last 40 years, of only $11\frac{3}{4}$ millions per annum, is not in accordance with the progress in the trade and realized property of the country; and that the raising of the duty from 2s. 6d. to 3s., in 1815, evidently checked for some time the increase of fire insurance that was previously going on.

Again, with regard to the exemption of farming stock, Mr. Coode argues that, as from 1834 to 1856 the total amount of farming stock exempt has only risen from $37\frac{1}{4}$ millions in 1834, to $62\frac{1}{4}$ millions in 1856, or a rise in 22 years of $67\frac{1}{2}$ per cent., whilst insured property, all that time subject to the duty, has risen from $483\frac{9}{10}$ millions to $802\frac{1}{2}$ millions, an increase in the same period of $65\frac{2}{3}$ per cent.—insured exempted property has only increased $1\frac{4}{10}$ per cent. more than insured property subject to the duty; and that, consequently, had all other property been exempted also, the only effect would be to raise the amount insured from £802,574,000 to £813,800,000. Of course, if his previous arguments are correct, that we have already reached nearly the full

limits of insurance of duty-paying property, there could be no great increase if the tax were taken off; but we have already seen how unreasonable such a supposition is; and consequently we may safely reply, that whilst agricultural stock rapidly came within the limits of insurance, till perhaps it approaches nearly to the full insurable value, of other property an immense amount would be open to the operations of the Insurance Companies, and would reward the exertions of the Companies with new business, in the same rapid manner as the insurance of agricultural stock increased after the exemption was first accorded. It is remarkable, that whilst Mr. Coode contends that no great increase in the insurance of agricultural stock has followed the abolition of the duty, as compared with other property still subject thereto, he gives a table, which to my mind proves the very reverse, and I consequently insert the comparison.

Increase of Property Insured.

	SUBJECT TO DUTY.	EXEMPT FROM DUTY. FARMING STOCK.	
		Increase per Cent.	Diminution.
Two years, 1835-6 . . .	4.13	8.78	..
Five „ 1837 to 1841 . .	11.04	19.61	..
Five „ 1842 to 1846 . .	12.75	15.32	..
Five „ 1847 to 1851 . .	7.09	6.29	..
Five „ 1852 to 1856 . .	14.60	..	.05

From this table it is evident that, in the first two years of the remission of the duty, the insurance of farming stock did increase at more than double the rate of other insurances, that in the following five years it increased at the rate of 80 per cent. more, in the next five again at 20 per cent. more, and that it was only when it may be reasonably supposed that the effect of the abolition of the duty had passed away, and when in fact the impulse that had been given to the business had done its work, that the amount remains stationary. Had the same rate of increase gone on in the other classes of insurance, the amount of fire insurance subject to duty would have been—

	£		£
In 1836 . . .	560,490,000	instead of	520,352,000
1841 . . .	663,140,000	„	590,461,000
1846 . . .	726,490,000	„	640,680,000

and there would even then have been a wide field for the operation

of the Companies, and the expansion of the business, very different from the limited one which the insurance of merely agricultural stock presents. But, though useful to prove that the remission of duty will lead to the increase of insurance, there seems no reason why agricultural stock should be exempted, in preference to any other kind of property; and if the rate of duty should be diminished to one half, it would be but just to those who are compelled to pay at all, that it should be replaced on the old footing, and charged equally with other property.

It seems to be inferred by Mr. Coode, that the Offices generally prefer leaving the duty as it is, because it helps to increase the allowance to the agencies, and that the public generally take little interest in the matter. There may be, no doubt, a few Companies which, for various reasons, may be indifferent to a change. It does not accord, however, with sound policy for them to contend for their agencies being supported by a commission from a Government duty, from which they get but a small profit, to the exclusion of their own proper business, which, if the agents exert themselves to procure the same income by commission on premiums, would benefit the Companies and the public as well, since insurance is generally admitted on all hands to be a public benefit. There is no reason to believe that the Companies which support the present high rate of duty, levied to the discouragement of their business and the burden of the public, are either the majority in number or the most influential in position, though one or two may deservedly rank high. On the contrary, so far back as 1836, a letter was addressed to the Chancellor of the Exchequer, signed on behalf of some of the leading Fire Insurance Companies by the secretaries or managers, when the result of the conference with the Minister with the deputation appointed to wait upon him for the purpose of discussing the question relative to the proposed total exemption of "barns, stables, and other outbuildings, *bond fide* used for agricultural purposes," from the 3s. annual duty on fire insurances, became known. In this letter they earnestly press for a more comprehensive and enlarged consideration of the bearing of the fire insurance duty; they point out that the pressure of taxation, though not sufficient to crush the growth of insurances, has long been felt most seriously to depress their natural buoyancy and expansion, that it tends to encourage a person to stand his own insurer for a portion of his property, and that the 3s. duty is heavy enough to act as a bounty to leave it uninsured. The records of fires prove the fact; and it is considered no exaggeration to say that greatly

more than half the property of the country is uninsured. In districts where fires are not very frequent, it is their conviction that the duty has the most powerful and pernicious effect, nearly totally restraining the practice; and, in all cases, the charge of a 3s. duty against a 1s. 6d. premium (the rate charged for full half of all the existing insurances) leads to the closest economy of the sums insured, independent of the cases which it altogether excludes from insurance. A rate of taxation of 200 per cent. (nearly one half of which is a war tax after 20 years' continued peace) presses heavily on the industrious classes, and the smaller class of capitalists and traders, who cannot become their own insurers without a risk ruinous to their fortunes and credit.

The managers of these Offices, however, not relying wholly on these arguments, represent their clear and unshaken conviction, that a large and general reduction of the rate of duty would be far from injurious to the revenue, in any proportion to its nominal sacrifice; and consider that a capital half as large again as that now protected would be ultimately brought to pay to this branch of revenue; and that a duty of 1s. 6d., in lieu of 3s., would not be felt so as to retard the progress of the business. At the same time, they suggest that the total exemption for one sort of property, whilst so heavy a rate of duty is left upon all others, is calculated to create dissatisfaction with the public, and prejudice the chance of a fair consideration of the general question. This document is signed by the managers or secretaries of the Sun, Royal Exchange, Guardian, Globe, Phoenix, Westminster, Imperial, Union, London Assurance, Atlas, County, and Alliance, names well known as the leading Offices in London. It nearly rebuts the assertion that the Offices generally support the continuance of the duty at its present rate.

Nor have the public been idle. In 1854, a petition was presented to the House of Commons, in which, after enumerating the changes in the rate of duty, the petitioners state—"That during nearly 40 years of almost uninterrupted peace, no alteration has been made in the duty of fire insurances (the repeal of that on farming stock only excepted), notwithstanding the Fire Insurance Offices and the public have made repeated efforts to obtain some reduction thereof, by petitions presented to your Honourable House, and by representations to the Chancellor of the Exchequer for the time being. That there is no doubt that the reduction in the ordinary rate of premium in late years would have led to a far greater increase of business, if the onerous tax of 3s. per cent. had

not operated as a check thereto. That a vast portion (it is fully believed three fifths) of the property of the country is unprotected by insurance, partly owing to the high duty. That the unexampled progress of fire insurance in France affords a practical illustration of the facility with which the business is capable of increase when unfettered by taxation; the sum covered in the year 1852 in Great Britain and Ireland, where fire insurance has been known for rather more than a century and a half, being about 880 millions sterling; and in France, where it has been in operation for only 35 years, being about 1,415 millions sterling. That reduction in taxes is far from involving a loss of revenue to the extent of such remission."

And the petitioners pray for the entire abolition of the stamp duty of 1s. on each policy, and for a considerable reduction in the annual duty of 3s. per cent.

This petition was signed by 3,798 persons—merchants, bankers, and inhabitants of London and its vicinity—men whose position in society and large commercial dealings gave them the best opportunities of knowing the practical effect of this tax on the insurance of private property or commercial products.

There can be little doubt of the fact, that the tax is generally felt to be oppressive and in excess; that it discourages to a very serious extent the prudent practice of insurance, and, consequently, leaves a very large amount of property unprotected; and that the reduction of the duty, even to 1s. 6d. per cent., would in a very short time so augment the proceeds as to show no material difference in the revenue, whilst it would place this country more on a level with the position which it ought to occupy for its wealth and greatness, compared with the other nations of Europe, in which such rapid strides have been made within a few years in the development of the most useful and beneficent system of insurance.

FOREIGN INTELLIGENCE.

GERMANY.—*The Progress and Position of Assurance Companies in Germany in the Year 1855.*—By Wilhelm Lazarus, of Hamburg, Corresponding Member of the Institute of Actuaries. (Translated and abridged by S. B., from Hubner's *Jahrbuch für Volkswirtschaft und Statistik.*)—Continued from p. 293, vol. vii.

TABLE N.—*Business of the German Hail Insurance Companies in 1855.*

A. SHARE COMPANIES.

Name.	Place.	Year of Establishment.	SHARE CAPITAL.		Sums Insured.	RECEIPTS.		Losses.	PAYMENTS.		Surplus.	Loss.	INTEREST AND DIVIDENDS TO SHAREHOLDERS.		Funds of the Company.
			Nominal.	Paid up.		Premiums.	Interest.		Reinsur. and Losses.	Charges.			Per Share.	Per cent. of Capital paid up.	
Erste Oester. Vers. Gesellschaft (First Austrian Assur. Co.)	Vienna	1824	Thalers.	Thalers.	Thalers.	Thalers.	Thalers.	Included in Fire Insur.	Thalers.	Thalers.	Thalers.	Thalers.	Thalers.	Thalers.	Thalers.
Assicurazioni Generali (General Insurance Company)	Trieste	1831	Ditto		Included in Fire Insur.				906,380	..	..	..	..	..	..
Neue Berliner Hagel Vers. Ges.	Berlin	1832	1,000,000	200,000	30,500,000	288,282		2,211	300,907	25,070	..	97,695	..	..	902,325
(New Berlin Hail Insurance Company)								..							
Kölnische Hagel Vers. Ges. (Cologne Hail Insurance Company)	Cologne	1853	2,000,000	400,000	?	254,667		..	172,587		82,080	..	5	..	2,057,080
Ceres Hagel Vers. Ges. (Ceres Hail Insurance Company)	Magdeburg	1855	261,800	52,360	?	47,340	1,927	542	31,848	10,557	2,508	..	1 th. 16	?	262,301
Magdeburger Hagel Sch. Vers. Ges. (Magdeburg Hail Insurance Company)	Magdeburg	1854	1,500,800	300,100	?	355,415	27,219	5,914	388,921	78,651	..	84,986	..	..	1,415,570
Union Allg. Deutsche Hagel Vers. Ges. (Union General German Hail Insur. Comp.)	Weimar	1855	2,509,500	501,900	?	183,640	28,485	..			169,348	..	..	5 per ct.	2,563,151

TABLE N (continued).
B. MUTUAL COMPANIES.

Name.	Place.	Year of Establishment.	Sums Insured.	RECEIPTS.		PAYMENTS.		Surplus.	Additional Payments by the Insured.	Dividends to the Insured.	Funds of the Company.	Premium per 100 Thalers.
				Premis.	Intrst. &c.	Losses.	Charges.					
Hagel Schäden Versich. Gesell. (Hail Loss Insurance Company)	Neubrandenburg	1797	Thalers. 12,831,425	Thalers. ..	Thlrs. ..	Thalers. 33,356	Thalers. ..	..	Thalers. ..	..	Thalers. ..	7½ s. gros.
Hagel Assurance f. d. Adelzuter u. Klöster des Herzogthums (Hail Insurance for the Noble and Conventual Property of the Duchy)	Kiel.....	1818	2,500,000	..	..	Not known.	..	..	..	..	..	..
Gesellsch. z. gegens Hagel Schäden Vers. (Society for Insur. against Hail)	Leipzig	1824	10,601,406	87,931	9,046	113,101	12,927	..	28,951	..	19,576	..
Hagel Schäden Versich. Gesell. (Hail Loss Insurance Company)	Schwedt	1826	12,627,480	99,531	..	171,085	..	..	{ 80 per ct. of the Premis.	..	..	..
Hagel Vers. Ges. f. Hannover u. Braunschwg. (Hail Insur. Comp. for Hannover and Brunswick)	Hanover	1833	10,000,000	..	..	Not known.	..	..	..	..	..	..
Hagel Ver. Ges. f. d. Bewohner des Platten Landes (Hail Insur. Comp. for the Inhabitants of the Lowlands)....	Marienwerder ...	1841	4,187,600	49,540	..	55,990	..	..	8,896	..	42,282	..
Hagel Versich. Gesell. (Hail Insur. Company)	Griefswald	1842	9,929,000	..	..	28,135	..	..	..	..	..	8½ s. gros.
Hagel Vers. Verein (Hail Insurance Association)	Gustrow	1842	24,000,000	..	..	Not known.	..	..	..	..	..	..
Hagel Schäden Versich. Gesell. (Hail Loss Insurance Company)	Erfurt.....	1845	12,418,625	100,487	9,133	138,378	26,044	..	54,262 { 20 per ct. of Premis.	..	..	..
Gesells. f. gegens Hagel Sch. Vergütung (Company for Indemnity against Hail Losses)	Altenburg	?	720,708	5,645	..	6,767	768	..	..	..	1,549	..

All accounts are wanting of the Hail Insurance Company in Wurttemberg, established 1838; in Greussen, established 1831; in Bavaria, established 1833; in Baden, established 1824; of the Germania, in Berlin, established 1847; of the Hail Insurance Company for Garden Grounds, in Berlin, established 1847; and of the Saxonia, in Bautzen, established 1850.

Cattle insurance, by local mutual Associations, has, up to the present time, been only carried on on a small scale, and their accounts have not been received. The share Companies which pursue this branch of business are the Assicurazioni Generali, in Trieste, which has published no special information thereon, and the Magdeburg Cattle Insurance Company in Magdeburg, established in 1855, with a share capital of 250,000 thalers.

From June, 1855, to the end of May, 1856.

	Horses.	Cattle.	Sheep.	Pigs.	Goats.	Sums insured.	Premiums.
Insured.....	8,495	23,164	61,203	1,770	348	Thalers. 2,894,044	Thalers. 132,086
Losses	197	280	1,680	33	1	28,560	..

The *reassurance* business of the German Companies is very considerable, as is perceived by the deductions made for reassurance premiums in the accounts of some of the Companies; but the actual amount does not come under observation, being included in the other business of the Company. The Companies which confine themselves exclusively to reassurance are few in number. They are—

TABLE O.

Name of Company.	Name.	Esa- blished.	SHARE CAPITAL.		SUMS ASSURED.	
			Nominal.	Paid-up.	In course of the Year.	In force at end of Year.
1. Aachener Ruck-ver.Ges.(Aix- la-Chapelle Reassur. Co.) ..	Aix-la- } Chapelle }	1853	Thalers. 3,000,000	Thalers. 600,000	Thalers. ?	Thalers. ?
2. Cölnische Ruck-vers. Ges. } (Cologne Reassurance Co.) ..	Cologne }	1853	3,000,000	600,000	124,284,630	262,198,504
3. Thuringia Eisenb. in Allg. Ruck-vers. Ges. (Thuringia Railway & Gen. Reassur. Co.)	Erfurt ..	1853	2,000,000	400,000	?	?
4. Ruck-vers.Verein d.Niederch. Güter Assec. Ges. (Reassur. Assoc. for the Lower Rhine —Goods Insurance Co.)	Wesel ..	..	..	..	?	?

TABLE O (continued).

	RECEIPTS.				PAYMENTS.					Capital Reserve.	Dividends on Paid-up Capital.
	Brought forward.	Premis.	Intrst.	Incidental Receipts.	Losses.	Charges.	Interest to Share- holders.	Reserve for Losses and Prem.	Surplus for the Year.		
1.	Th. 97,459	Th. 152,209	Th. 15,721	Th. ..	Thalers. 104,394		Th. ..	Th. 110,336	Th. 51,639	Th. 11,351	7½
2.	28,296	399,778	29,793	6,763	320,036	16,646	24,000	89,546	43,788	3,278	4
3.	198,907	451,679	21,014	13,258	452,199	18,591	..	174,987	30,000	10,000	6
4.	28,000	70,074	486	..	71,146	4,566	..	17,000	5,848	22,050	..

Of these Companies, the Aix-la-Chapelle insures only against fire, the Cologne in all branches; the Thuringia gives these statements in their accounts as excluding hail and life assurance; and the Wesel Company is confined to river insurance. The Thuringia increased its share capital in 1856 to 3,000,000 thalers, and took up the business of direct assurance.

SUMMARY FOR 1856.

At the time of the publication of the Year Book, the accounts of the Companies had not come in, but the following table shows generally the position of the leading Companies:—

Fire Insurance Companies for 1856.

Name of Company.	(1.) Sums Insured at end of the Year.	DURING THE YEAR. ^a		(4.) Dividend and Interest on Paid-up Capital.
		(2.) Premium Receipts.	(3.) Losses.	
<i>A. Proprietary.</i>	Thalers.	Thalers.	Thalers.	Per Cent.
Berlin Fire Insurance Company . . .	66,000,000	?	?	21
Aix-la-Chapelle and Munich Fire Insurance Company	817,587,870	^b 1,449,047	^c 1,164,696	40
Fatherland Fire Insurance Com- pany, Elberfeld	273,260,802	^d 1,096,008	678,734	5
First Austrian Insurance Company, Vienna	309,449,420	^b 1,373,418	..	25
Bavarian Mortgage and Exchange Bank	125,856,000	262,200	189,741	..
Riunione Adriatica, Trieste ^d	291,776,437	^b 1,462,304	1,192,323	5
Colonia	506,158,119	894,112	788,715	30
German Phoenix	255,000,000	455,634	..	16
Fire Insurance Company of 1843, Hamburg	11,274,534	93,497	19,714	5½
Magdeburg Fire Insurance Company	638,714,358	^b 1,599,140	945,189	9¼
Silesian Fire Insurance Company ..	195,472,756	^c 517,740	301,611	7
Hamburg Bremen. Fire Insurance Company	29,667,702	82,005	7,809	20
Prussian National Insurance Com- pany, Stettin	459,969,989	..	..	7
Credit and Insurance Bank, Lubeck..	4,658,400	11,304	(nil)	..
<i>B. Mutual Companies.</i>				
Wurtemberg Private Fire Insurance Company	unknown	..	38,397	..
Fire Insurance Bank at Gotha	359,210,618	..	331,555	60
Marienwerder of 2nd March, 1856 .	349,967,475	..	..	..
Mobilair Fire and Hail Insurance Company, Griefswald	25,871,475	..	3,593	..
Knightly Fire Society, Rostock . . .	19,028,985	..	23,962	..
Mobilair Fire Insurance Society, New Brandenburgh	6,563,475	..	9,200	..
Fire Insurance Company, Güstrow ..	22,567,724	..	45,232	..
Bavarian Immobiliar Company . . .	387,390,750	..	687,085	..
Silesian Society for Breslau	35,678,510	..	38,947	..
" " Provincial Towns . .	23,108,130	..	75,769	..
" " Country	35,568,790	..	20,599	..
Frankfort Fire Insurance Company .	36,008,374	..	7,077	..
Agricultural Fire Fund, Hildesheim	65,144,235	..	183,613	..
Country Fire Insurance Company, Brunswick	50,987,625	..	58,286	..

In 1857, the Dresden Fire Insurance Company was established, with a share capital of 3,000,000 thalers, in shares of 1,000 thalers, with 20 per

^a Premium reserve from former year included in the receipts; premium reserve for next year included in column (3), or deducted from both sides of the account; so with reinsurance premiums and share of losses.

^b Insurances in force together.

^c Including interest and reserve.

^d Including transport insurance.

^e New assurances in the year.

cent. paid up. The Fire, Life, and Transport Insurance Company, "Providentia," was also established at Frankfort-on-Maine.

The Berlin Fire Insurance Company, which, up to the present time, was working with a capital of 850 shares of 1,000 thalers each, and 20 per cent. paid up, has doubled its capital, whilst the new shares were allotted to the original proprietors and the total receipts therefrom added to the reserve fund, which amounted to 232,900 thalers; and, after deduction of 170,000 thalers, the 20 per cent. required on the new capital still left 62,900 thalers; 300 further shares were also to be issued, and the total capital would then amount to 2,000,000 thalers.

Life Assurance Companies, 1856.

Name of Company.	Sums Assured at end of the Year.	DURING THE YEAR.		Interest and Dividends.
		Premium Received.	Claims by Death.	
<i>A. Share Companies.</i>	Thalers.	Thalers.	Thalers.	Thlrs.
Leipzig Life Assurance Society.....	5,046,000	190,962	169,000	21
Stuttgart Life Assurance and Savings' Bank	1,590,144	..	10,457	..
Frankfort Life Assurance Society ...	1,540,933	?	19,238	6
Magdeburg	509,550	16,356	(nil)	?
Hamburg—Janus.....	4,250,000	152,000	45,000	?
Concordia	5,197,780	..	200,000	..
Berlin Life Assurance Society.....	9,848,600	..	224,400	14 $\frac{2}{3}$
<i>B. Mutual Companies.</i>				
Iduna, in Halle	1,641,683	38,977	5,443	..

The Life Insurance Company "Germania," recently established in Stettin, has taken over the business of the Company "Vorischt" (Providence), in Weimar. The Germania has 3,000,000 thalers share capital, 6,000 shares, of which 10 per cent. is paid up.

Hail Insurance.

Name of Company.	Sums Insured.	Premium Receipts.	Losses and Reinsurances.	Interest and Dividends.
<i>A. Share Companies.</i>	Thalers.	Thalers.	Thalers.	Thlrs.
Magdeburg Company	unknown	664,614	641,792	0
Cologne Company	unknown	332,540	^a 356,757	0
Ceres, in Magdeburg ^b	3,554,727	27,612	42,313	4
New Berlin Company	29,200,000	295,645	336,702	0
Union, in Weimar .....	..	229,969	313,395	0

^a Total payments.

^b Out of 2,500 shares, only 1,309 are issued; on which 20 per cent., or 52,360 thalers, are paid up. After deduction of losses and expenses of management, only 9,986 thalers remain at the end of 1856.

Hail Insurance (continued).

Name of Company.	Sums Insured.	Premium Receipts.	Losses and Reinsurances.	Interest and Dividends.
<i>B. Mutual Companies.</i>	Thalers.		Thalers.	
New Wurtemberg Hail Insur. Comp.	635,238	..	7,299	..
Mardemverder	4,362,475	..	25,228	..
Altenburg ^a	611,287	..	5,000	..
Leipzig	10,103,721	..	222,736	..
Erfurt	10,839,150	..	184,229	..
Hanover, Brunswick	11,000,000	..	99,000	..
Neubrandenburg	4,099,950	..	28,213	..

In Bavaria, arrangements are going on for the formation of a new Bavarian Hail Insurance Company at Munich, with a share capital of 1,000,000 gulden.

Transport and Sea Insurance.

Name of Company.	Sums Insured.	Premiums Received.	Losses and Reinsurances.	Dividends.
	Thalers.	Thalers.	Thalers.	Thlrs.
Silesian Company, Breslau .....	..	202,177	47,778	7
General Railway Insur. Comp., Berlin ..	..	12,632	1,487	10
Fortuna, in Berlin .....	..	15,023	4,700	14
Prussian National Assurance Com- pany, Stettin	19,875,275	..	..	..
New Prussian Fire Insurance Company	..	19,314	15,430	20
Pomerania, in Stettin	7,000,000	81,915	69,000	4
Rhine Navigation Assurance Company	19,000,000	66,666	..	14
Dusseldorf General Transport In- surance Company .....	..	416,821	303,133	30
Agrippina, in Cologne .....	..	289,326	99,931	24
Credit and Assurance Bank, Lubeck	2,703,805	68,028	28,000	..
Phœnix, Frankfort-on-Maine .....	..	16,176	..	..
Stettin River Insurance Company ..	..	17,843	3,565	36

On the 16th December, 1856, a new Transport Insurance Company, the "Union," was formed in Stettin, with a capital of 1,200,000 thalers, in 3,000 shares, on which 25 per cent. is paid up.

Reassurance Companies.

Name of Company.	Sums Insured.	Premium Received.	Losses and Reinsurances.	Dividends.
	Thalers.	Thalers.	Thalers.	Thlrs.
Cologne	196,462,099	802,906	503,757	6
Aix-la-Chapelle .....	..	182,232	..	8½

GERMANY.—*New Business and Position of the German Life Assurance Companies for 1856.*—We have been favoured by Herr Rath G. Hopf, of Gotha, Foreign Correspondent of the Institute of Actuaries, with the following continuation of the interesting Tables which have appeared in previous

^a In the 10 years of its operations, the Altenburg Company has insured 4,035,928 thalers, received 31,502 thalers in premiums, and paid losses to the amount of 28,193 thalers.

TABLE I.—*New Business and Position of the Life Assurance Companies of Germany in the Year 1856.*

Established.	Name of Company.	Assurances existing at the beginning of the Year.		New Assurances during the Year.		Assurances existing at the end of the Year.		Income (Premiums and Interest).	Claims paid.		Expenses of Management.			Assurance Fund.				Average Dividend during the last ten years in per Cent. of Premium.	Share Capital.	
		Persons.	Sums.	Persons.	Sums.	Persons.	Sums.		Persons.	Sums.	Abso- lute.	Per Cent. of Income.	Per £1000 of Assured Sums at end of Year.	Amount.	Per Cent. of Assured Sum at end of Year.	Reserve advanced Premiums.	Clear Surplus.		Nominal.	Paid up.
		£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	£	
1827	Gotha....	19,363	4,412,672	1,314	311,871	20,098	4,579,914	209,778	98,914	405	98,914	8,594	4.09	1.88	26.60	987,667	201,914	27.10	Mutual	Mutual
1828	Lubeck ..	4,192	781,649	1,754	185,336	5,503	880,648	38,344	23,032	94	23,032	4,946	12.90	5.62	11.26	?	?	(0.293 On Sum Assured)	72,857	7,286
1830	Leipzig ..	4,717	775,086	229	34,386	4,749	772,286	35,835	24,143	135	24,143	2,195	6.13	2.84	28.48	188,094	23,085	12.2	Mutual	Mutual
1830	Hanover ..	*2,878	245,114	*93	10,886	*2,882	249,529	6,922	5,986	54	5,986	?	?	?	16.85	?	?	None	Mutual	Mutual
1834	Trieste....	3,300	714,286	460	100,000	3,600	771,428	48,147	21,428	100	21,428	?	?	?	..	111,150	19,882	None	200,000	20,000
1836	Berlin....	7,958	1,341,771	543	117,457	8,189	1,406,943	68,295	32,100	188	32,100	5,143	7.53	3.65	21.59	251,998	51,733	14.1	142,857	28,571
1836	Munich ..	2,136	224,073	340	37,779	2,315	247,208	9,286	45	45	4,327	?	?	?	15.88	?	?	None	Capital Loan Bank.	?
1839	Vienna ..	5,154	242,179	3,136	102,868	8,040	331,839	12,606	4,945	95	4,945	1,571	12.47	4.74	9.82	?	?	13	Mutual	Mutual
1842	Brunswick	916	70,071	76	6,543	966	74,000	2,837	15	15	1,028	?	?	?	13.87	?	?	c. 6	Mutual	Mutual
1844	Frankfort.	1,102	211,670	118	22,029	1,156	220,177	11,209	20	20	3,767	1,239	11.06	5.63	..	48,577	7,890	5	244,898	24,489
1845	Hamburg.	1,430	137,477	250	24,146	1,436	138,106	4,646	2,636	28	2,636	1,534	33.02	11.11	0.69	?	?	None	4,561	4,561
1847	Hannoveria (Hannoveria)	*4,289	511,760	*1,242	126,154	*5,184	602,821	22,603	7,847	58	7,847	4,201	18.59	6.97	6.67	?	?	7.3	71,429	7,143
1852	Leipzig... (Teutonia)	*754	52,518	*283	21,382	*991	68,627	4,094	745	7	745	1,706	41.67	24.86	..	14,768	None	None	85,714	8,571
1853	Schwerin..	*126	21,857	*96	17,286	*217	38,114	1,429	257	2	257	?	?	?	4.50	?	?	None	14,286	1,429
1853	Cologne ..	1,400	415,075	1,200	384,710	2,500	742,540	22,857	4,179	26	4,179	?	?	?	?	?	?	None	869,714	173,943
1854	Stuttgart..	859	125,379	360	66,155	1,187	186,343	6,864	1,494	6	1,494	695	10.13	3.73	6.26	7,304	4,318	None	Mutual	Mutual
1854	Halle	*944	98,614	*563	61,471	*1,378	137,607	6,857	1,165	10	1,165	907	13.22	6.59	2.48	5,919	None	None	28,571	28,571
1855	Darmstadt	71	11,575	729	28,304	784	39,386	1,269	143	12	143	?	?	?	..	?	?	None	Capital of the Annuity Society.	?
	Total ..	61,589	10,392,822	12,786	1,658,763	71,175	11,488,116	513,898	238,136	1,300	238,136	..	..	..	2,220,958					

* Policies.

TABLE II.—*Showing the Gross Premium per Cent., the Average Dividends,*

Established.	Name of Company.	Average Dividend per Cent.	Age 25.			Age 30.			Age 35.		
			Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.
1827	Gotha	27 $\frac{3}{10}$	2 356	0 643	1 713	2 633	0 719	1 914	2 969	0 811	2 158
1828	Lubeck	0 293	2 403	0 293	2 110	2 669	0 293	2 376	2 992	0 293	2 699
1830	Leipzig	12 $\frac{1}{2}$	2 356	0 302	2 054	2 633	0 337	2 296	2 969	0 380	2 589
1834	Trieste (Assicurazioni Generali) }	Non profit	..	..	2 14	..	..	2 42	..	..	2 76
		<i>Old Tariff:</i> 14 $\frac{1}{2}$	2 406	0 349	2 057	2 672	0 387	2 285	2 992	0 434	2 558
1836	Berlin	<i>New Tariff:</i> Not yet divided	2 133	?	?	2 433	?	?	2 817	?	?
		Non profit	..	..	2 000	..	..	2 283	..	..	2 658
1836	Munich.....	Non profit	..	..	2 167	..	..	2 433	..	..	2 750
1839	Vienna (Mutual)..	c. 13	2 150	0 279	1 871	2 483	0 323	2 160	2 883	0 375	2 508
1842	Brunswick	c. 6	2 125	0 127	1 998	2 382	0 143	2 239	2 722	0 163	2 559
1844	Frankfort.....	Non profit	..	..	1 992	..	..	2 242	..	..	2 550
1845	Hamburg..... } (Hammonia) }	Non profit	..	..	1 917	..	..	2 175	..	..	2 483
1847	Hamburg (Janus)..	Non profit	..	..	1 950	..	..	2 225	..	..	2 542
1851	Trieste (Azienda Assicuratrice) }	Non profit	..	..	2 12	..	..	2 40	..	..	2 76
1852	Vienna (First Austrian Assurance Company) }	Non profit	..	..	2 100	..	..	2 383	..	..	2 717
1852	Leipzig (Teutonia)	Not yet divided	2 181	?	?	2 500	?	?	2 861	?	?
1853	Trieste (Riunione Adriatica di Sicurtà)	Non profit	..	..	1 96	..	..	2 25	..	..	2 57
1853	Cologne	Non profit	..	..	1 783	..	..	2 042	..	..	2 383
1853	Schwerin	Not yet divided	2 203	?	?	2 521	?	?	2 906	?	?
1854	Halle.....	Not yet divided	2 192	?	?	2 500	?	?	2 861	?	?
1854	Stuttgart	Not yet divided	2 230	?	?	2 457	?	?	2 760	?	?
1855	Darmstadt	Non profit	..	..	1 750	..	..	2 017	..	..	2 350
1856	Magdeburg	Non profit	..	..	1 867	..	..	2 083	..	..	2 358
1856	Erfurt	Non profit	..	..	1 758	..	..	2 008	..	..	2 333
1857	Stettin	Non profit	..	..	1 817	..	..	2 075	..	..	2 408
1857	Frankfort..... } (Providentia) }	Non profit	..	..	1 883	..	..	2 125	..	..	2 425
	Average Premium	..	2 249	..	1 953	2 535	..	2 211	2 885	..	2 529

and the Net Premium after Reduction, in the German Life Assurance Companies.

Age 40.			Age 45.			Age 50.			Age 55.			Age 60.		
Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.
3386	0.924	2.462	3.961	1.081	2.880	4.733	1.292	3.441	5.742	1.568	4.174	7.161	1.955	5.206
3400	0.293	3.107	3.894	0.293	3.601	4.531	0.293	4.238	5.317	0.293	5.024	6.367	0.293	6.074
3386	0.433	2.953	3.961	0.507	3.454	4.733	0.606	4.127	5.742	0.735	5.007	7.161	0.917	6.244
..	..	3.21	..	..	3.81	..	..	4.66	..	..	5.78	..	..	7.25
3400	0.493	2.907	3.898	0.565	3.333	4.533	0.657	3.876	5.317	0.771	4.546	6.367	0.923	5.444
3333	?	?	3.950	?	?	4.750	?	?	5.858	?	?	7.417	?	?
..	..	3.150	..	..	3.758	..	..	4.558	..	..	5.650	..	..	7.142
..	..	3.183	..	..	3.750	..	..	4.517	..	..	5.533	..	..	6.933
3333	0.433	2.900	3.950	0.513	3.437	4.733	0.615	4.118	5.667	0.737	4.930	6.967	0.906	6.061
3187	0.191	2.996	3.805	0.228	3.577	4.660	0.280	4.380	5.854	0.351	5.503	7.479	0.449	7.030
..	..	2.950	..	..	3.433	..	..	4.192	..	..	5.142	..	..	6.422
..	..	2.875	..	..	3.400	..	..	4.097	..	..	5.000	..	..	6.208
..	..	2.950	..	..	3.425	..	..	4.100	..	..	5.125	..	..	6.492
..	..	3.24	..	..	3.84	..	..	4.64	..	..	5.70	..	..	7.23
..	..	3.167	..	..	3.767	..	..	4.550	..	..	5.633	..	..	7.183
3300	?	?	3.900	?	?	4.667	?	?	5.624	?	?	6.833	?	?
..	..	2.99	..	..	3.62	..	..	4.35	..	..	5.55	..	..	7.07
..	..	2.825	..	..	3.417	..	..	4.208	..	..	5.267	..	..	6.692
3391	?	?	4.005	?	?	4.802	?	?	5.906	?	?	7.661	?	?
3317	?	?	3.850	?	?	4.600	?	?	5.750	?	?	7.200	?	?
3182	?	?	3.757	?	?	4.572	?	?	5.688	?	?	7.077	?	?
..	..	2.800	..	..	3.433	..	..	4.300	..	..	5.550	..	..	7.317
..	..	2.758	..	..	3.333	..	..	4.108	..	..	5.033	..	..	6.300
..	..	2.750	..	..	3.317	..	..	4.083	..	..	5.267	..	..	6.717
..	..	2.842	..	..	3.417	..	..	4.192	..	..	5.208	..	..	6.592
..	..	2.821	..	..	3.396	..	..	4.167	..	..	5.212	..	..	6.671
3329	..	2.945	3.903	..	3.498	4.665	..	4.233	5.679	..	5.230	7.063	..	6.585

numbers of the *Magazine*. The statement for 1855 will be found in vol. vi. pp. 353-6, where reference will also be seen to preceding years. It will be noticed, the Weimar Company (Vorsicht), established in 1852, is not in the list; and that of Darmstadt, established in 1855, is added. A considerable increase has again taken place in the new business in 1856 as compared with 1855—the number of lives or policies being in the former 12,786 for £1,658,763; and in the latter, 9,366 for £1,361,711; and the assurances in force at the end of the year, 71,175 persons, or policies for £11,488,116, compared with 61,589 persons, or policies for £10,392,822, existing at the beginning of the year. The income from premiums and interest has increased from £477,281 in 1855, to £513,898 in 1856, whilst the claims paid have diminished in number from 1,426 in 1855 to 1,300 in 1856, but slightly increased in amount from £225,319 in the former to £238,136 in the latter year. The assurance funds have increased from £2,099,643 in 1855 to £2,220,958 in 1856.

The average amount assured by each policy is still diminishing. In 1856, it is a little below £130. In 1855, it was £145; and in 1852, £161. It is fair to infer, that the benefits of life insurance are extending in Germany to the class who most require it. The average amount of each assurance in force at the end of 1856 was £16; and of each claim in the year, £183, which is much above the average.

The new assurances in 1856, as compared with 1855, have increased 21·8 per cent.; the assurances in force at the end of the year, 10·5 per cent.; the claims, by 5·7 per cent.; and the assurance funds, after deducting claims and expenses, 5·8 per cent. The claims on the assurances in force at the beginning of the year, added to half the new business of the year, have been 2·12 per cent., which is rather less than in the previous year. (S. B.)

CORRESPONDENCE.

ON THE BEST METHOD OF CONSTRUCTING AN INDEX.

To the Editor of the Assurance Magazine.

SIR,—Having recently had occasion to construct an index of the lives assured in the “Eagle” Company, I beg leave to submit to you a few observations upon the subject, which, if brought under the notice of your readers, may, perhaps, be interesting and useful to them.

The requirements of an index, and the proportions of its several parts, are the two principal questions to be considered.

Under the first head, it may be observed, that the index of a Company upon a large scale should afford as much abstract information as possible. Those who refer to it do so with different views, for the objects of their inquiry must necessarily vary with their respective duties; it is, therefore, desirable that the index should be constructed with a view to provide for the wants of each person, so far at least as to enable him to obtain information in the most direct way; and it will be proper to insert in the index particulars, some of which do not usually find a place in such a book.

Let it be supposed that an individual, signing his name “J. Smith,” inquires about the bonus, premium, or assignment, &c., of his policy, without stating either number, date, or amount. This is not an unusual case,

and it will serve to illustrate my meaning, by showing the nature of the difficulties which have to be encountered. J. may stand for John, James, Joseph, &c.; there will probably be many of each kind in connexion with the like surname, and it would be very difficult to discover, without a tedious investigation, to which policy "J. Smith" refers, unless the individuality of each person recorded in the index under that name be distinctly shown. The "locality" of the assurance might be adopted as a mark of distinction; and we should, in many instances, be able to fix upon the right name by simply comparing the address of the writer with the place where the policy was effected.

It is required to be able to ascertain the amount already assured upon any one life, when a further assurance thereon is proposed; but how, in the case of "J. Smith," or any other equally common name, can this be determined easily, unless there be some unfailing method of identifying the life proposed with the life previously assured? The "date of birth" will be the best evidence for this purpose: it is stated in the proposal, and, if recorded in the index, would be of great assistance in determining the amount of assurances already existing upon the given life. If it be important to be able to ascertain this with expedition and certainty in an individual case, how much more so when it is proposed to take over the business of another Company!—for, in the latter case, it will be necessary to immediately reassure the lives which, by the combination of assurances, will have become risks beyond the maximum limit.

For these and other considerations, which it would be needless to mention here, and allowance being made for any peculiar construction of the other office books, I think that the "heading" of an index, to be generally useful, should provide for the following particulars, viz.:—surname, Christian name, date of birth, agency or address; the number of the policy or policies upon the same life, amount, and month of renewal—the month of renewal to be indicated by a numeral placed under the number of the policy. One line in the folio of a book of moderate size (say, in inches, 16 by 20½) will suffice for all ordinary cases; one half being reserved for the particulars under the first four heads, and the other half for the last three: in the latter half there will be ample space for the particulars of five policies upon the same life. The compactness of this mode of entry will be its own recommendation.

Those who are familiar with the daily operations of an Assurance Company will perceive the advantage of constructing an index upon this plan. Thus expanded, the index would of itself afford information on some points, and indicate the nearest way to obtain it on others. Time and labour would be economised, reference be made easy in the operation and sure in the result, and the usefulness of this auxiliary book would be extensive and complete.

With regard to the second part of this subject—*i. e.* the proportions of the several parts of the index—I may observe, that the most useful mode of division appears to me to be that which is adopted by many Offices—namely, to classify the surname under its first letter, and to subdivide according to the first vowel thereafter, adopting the first subdivision for such names as "Ash," "Epps," &c., which have no succeeding vowel. The prefixes De, Mac, O', Von, &c., must be regarded as forming a part of the surname; and, as such, will of course indicate the division under which the names should be classed. Any change of name amongst the assured, either by royal permission, marriage, or succession to title, should be noticed

in the index. It will, however, be quite sufficient if the new name or title alone be recorded, with a reference to the former one in connexion with which the particulars are entered.

The relative proportion which each division of the index should bear to the others may be found without difficulty from the commercial lists of the *Post Office Directory*, containing, as they do, the names of the middle class of people from which assurance business is principally obtained.

The result of an analysis of some of these commercial lists, also of the index of three Assurance Companies, will be seen in the following table. The column showing the total average is founded upon a classification of nearly 233,000 surnames. The table gives the percentage to the nearest first decimal.

TABLE I.

First Letter of Surname.	Commercial Directory, London.	Directory Average of Liverpool, Hull, Manchester, Sheffield, Birmingham, Bristol.	Assurance Companies.			Total Average.
			A.	B.	C.	
A	3.1	3.2	3.1	3.0	2.8	3.1
B	10.9	11.8	11.3	10.3	11.1	11.2
C	8.5	7.7	7.8	7.8	7.7	8.1
D	4.3	4.1	4.6	4.9	5.2	4.3
E	2.4	2.3	2.2	1.8	3.0	2.4
F	3.6	3.3	3.5	4.0	2.8	3.4
G	5.1	4.7	5.2	5.1	4.2	4.9
H	8.6	9.4	8.6	7.8	9.4	8.9
I, J	3.2	3.8	2.9	3.1	4.1	3.4
K	2.0	1.9	2.2	2.7	1.8	2.0
L	4.7	4.5	5.4	4.8	4.4	4.6
M	6.7	7.2	7.4	7.8	7.4	6.9
N	2.0	1.6	1.7	1.6	1.9	1.9
O	1.0	1.2	1.5	1.2	.8	1.1
P	5.9	5.5	5.6	5.6	5.9	5.7
Q	.2	.1	..	.1	.2	.1
R	4.6	4.9	5.1	5.7	4.9	4.7
S	9.7	8.9	8.7	8.6	7.8	9.3
T	4.1	4.5	4.0	4.6	5.2	4.3
U, V	1.0	.7	1.6	1.3	.8	.9
W	7.9	8.7	7.4	7.9	8.2	8.2
X	..	..	..	..	..	..
Y	.5	.4	.3	.3	.4	.4
Z	.1	.1	.2	.2	..	.1

The general agreement of the several lists is very striking; and one cannot but regard the result shown by the total average as a very proper basis for the primary division of a well-proportioned index.

It is to be observed, that the "experience" of the A and B Assurance Companies very closely follows the general average. The books of these two Companies are subdivided in the manner before suggested; and it will be fair to assume that the proportions which their lists of names bear to one another may be adopted for regulating the subdivisions of an index to be constructed upon a much larger scale.

Table II. has been formed from the lists of the A and B Companies, with a view to show the proportion per cent. which each subdivision bears to its respective division.

TABLE II.

Division.	Subdivision.						Division.	Subdivision.					
	a.	e.	i.	o.	u.	y.		a.	e.	i.	o.	u.	y.
A	15	48	16	10	7	4	N	12	40	21	20	6	1
B	30	18	10	24	16	2	O	30	26	19	18	4	3
C	38	6	7	39	10	..	P	31	23	19	18	6	3
D	32	24	8	14	20	2	Q	..	..	..	..	1	..
E	46	22	18	9	3	2	R	16	21	15	39	6	3
F	22	25	20	29	3	1	S	30	21	23	14	9	3
G	31	16	22	24	5	2	T	19	13	11	36	17	4
H	38	14	7	28	12	1	U, V	19	17	26	35	3	..
I, J	20	30	3	45	2	..	W	28	18	41	11	..	2
K	12	32	41	9	5	1	X	..	..	..	..	..	..
L	27	29	10	22	8	4	Y	39	11	..	50	..	..
M	51	7	11	21	8	2	Z	50	5	16	24	5	..

The index of the Eagle Company has been constructed upon a scale sufficiently extensive to provide for the record therein of the names of 25,000 individuals, and to allow for 35 of them to each folio, making altogether 714 folios. The number of folios allotted to each division and subdivision will be seen in the next table. It must, however, be observed that, although the Tables I. and II. form the basis of allotment, some necessary adjustment has been made for the small quantities.

TABLE III.

Division.		Subdivision.						Division.		Subdivision.					
Letter.	Folios.	a.	e.	i.	o.	u.	y.	Letter.	Folios.	a.	e.	i.	o.	u.	y.
A	21	3	10	3	2	2	1	N	12	1	5	2	2	1	1
B	79	23	15	8	18	13	2	O	8	2	2	1	1	1	1
C	56	21	3	4	21	6	1	P	39	12	9	7	7	2	2
D	33	10	8	3	5	6	1	Q	1	..	..	..	..	1	..
E	18	8	3	3	2	1	1	R	36	6	8	5	13	2	2
F	25	5	6	5	7	1	1	S	63	19	13	14	9	6	2
G	35	10	6	8	8	2	1	T	26	5	3	3	9	4	2
H	63	25	9	4	17	7	1	U, V	8	1	1	2	2	1	1
I, J	31	6	9	1	13	1	1	W	56	16	10	22	6	1	1
K	15	2	5	5	1	1	1	X	1	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$
L	34	9	10	3	7	3	2	Y	2	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
M	51	26	4	6	10	4	1	Z	2	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$

It will be seen by this table, that if an index were to be separated into two or more volumes, the separation should be made after J, for two volumes; after G and P, for three volumes; and after D, J, and Q, for four volumes; the total number of names being, at these points, divided into nearly equal portions.

Trusting that the foregoing observations may be acceptable to your readers,

I have the honour to be, Sir,

Your obedient servant,

*Eagle Insurance Office,
23rd August, 1858.*

F. A. CURTIS.

ON THE ADVANTAGES OF THE MODERN METHODS OF COMPUTATION IN LIFE ASSURANCE CALCULATIONS.

To the Editor of the Assurance Magazine.

SIR,—At page 98, vol. i., of the *Assurance Magazine*, in a letter of your talented correspondent, Mr. P. Gray, “On the comparative Advantages of the Old and New Methods of Computation,” is given a problem in illustration of his subject, which has the recommendation of being one which actually occurred, the consideration of which led to the preparation of his remarks. The two following problems, which have also arisen in practice, and which are further illustrative of the same subject, may not be deemed unworthy of a place in your Journal.

I am, Sir,

Your obedient servant,

Eagle Life Office,
30th September, 1858.

SAMUEL L. LAUNDY.

PROBLEM.

A person, aged x , is assured for $\pounds m$, payable at the age $x+n$, or at previous death, at an annual premium, P , payable until age $x+n-1$. Being desirous of converting his assurance into another of similar amount, payable at death, he requires to know what premium, P' , he should pay for the rest of life.

Benefit terms.

x receives—1st, an assurance of $\pounds m$ payable
at death, the present value of which, multiplied by D_x , is $m \cdot M_x$;
2nd, remission of the premium P for the next
 n years, the present value of which, multiplied by D_x , is $P(N_{x-1} - N_{x+n-1})$.

Payment terms.

x gives up his present assurance, the value of which, multiplied by D_x , is $m(D_{x+n} + M_x - M_{x+n})$,
And pays a premium, P' , for the remainder of life, the present value of which, multiplied by D_x , is $P'(N_{x-1})$.

Equating the sum of the benefit terms to that of the payment terms,

$$P'(N_{x-1}) + m(D_{x+n} + M_x - M_{x+n}) = P(N_{x-1} - N_{x+n-1}) + m \cdot M_x;$$

$$\text{whence } P' = \frac{P(N_x - N_{x+n-1}) - m \cdot D_{x+n} - M_{x+n}}{N_{x-1}}.$$

PROBLEM.

A person, at age x , assured for $\pounds m$, at a premium P_x . At age $x+n$ he is desirous of knowing for what amount he can have a free policy in consideration of the premiums already paid.

Benefit terms.

1st, a free policy for $\pounds m'$, the present value of which, multiplied by D_{x+n} , is $m' \cdot M_{x+n}$;
2nd, remainder of premium P_x for the remainder of life, the present value of which, multiplied by D_{x+n} , is $P_x \cdot N_{x+n-1}$.

Payment term.

He gives up the reversion to £ m , payable at his
 decease, the present value of which, multiplied by } $m \cdot M_{x+n}$.
 D_{x+n} , is }

$$\text{Equating, } m' \cdot M_{x+n} + P_x \cdot N_{x+n-1} = m \cdot M_{x+n};$$

$$\text{whence } m' = \frac{m \cdot M_{x+n} - P_x \cdot N_{x+n-1}}{M_{x+n}} = m - \frac{P_x \cdot N_{x+n-1}}{M_{x+n}}.$$

$$\text{Let } m=1, \text{ then } m' = 1 - \frac{P_x \cdot N_{x+n-1}}{M_{x+n}};$$

$$\text{dividing by } N_{x+n-1}, \text{ we have } \frac{P_x}{M_{x+n} \div N_{x+n-1}} \text{ and } \frac{M_{x+n}}{N_{x+n-1}} = P_{x+n};$$

$$\therefore m = 1 - \frac{P_x}{P_{x+n}},$$

which agrees with the expression given by Mr. Sprague (*Assurance Magazine*, vol. vii., p. 59), derived from the assurance and annuity values.

It is to be observed, that the foregoing Problems include only the case where the premium is just due, and which is the one that will generally occur in practice. For the case where the premium has just been paid, the formulæ will have to be modified by the omission of -1 from all the terms of column N .

FORMULÆ FOR THE ANNUAL PREMIUM FOR A TERM ASSURANCE ON TWO JOINT LIVES.

To the Editor of the Assurance Magazine.

SIR,—It is probably very seldom that an assurance is effected for a term of years on the joint duration of two lives; and when such a case occurs, it will often be thought desirable to employ some method of approximation in order to determine the proper premium for the assurance. One such method may be mentioned. If a policy is to be effected for t years, on the joint duration of two lives, let it be calculated what would be the surrender value of a policy for the whole duration of the same lives, after it has been t years in force, or what percentage of the premiums paid would be returned; then if that percentage be deducted from the Office premium for an assurance for the whole duration of the lives, the remainder will be the premium for the term assurance. But it is desirable to show how such a premium may be calculated exactly, and the suitable formulæ will probably be new to many of the readers of the *Assurance Magazine*, as they are not given in David Jones's *Treatise on Annuities*, nor in any other work of which I am aware.

Let (a) denote the value of an annuity of £1 on the joint lives of the last v survivors of the lives $m, m_1, m_2, \&c.$; and (A) the value of an assurance of £1 on the same lives. Then, it is proved by Jones (Art. 197), that

$$(A)_t \uparrow = r \{ 1 + (a)_{t-1} \uparrow \} - (a)_t \uparrow.$$

Also, let (P) denote the annual premium for the same assurance;

then, $(P)_t] = \frac{(A)_t]}{1 + (a)_{t-1]}} ;$

or, substituting the value of $(A)_t]$ given above,

$$(P)_t] = r - \frac{(a)_t]}{1 + (a)_{t-1]}} .$$

which is a general formula for the premium for a term assurance.

When there is only one life, aged m , we have

$$a_{m_t}] = \frac{N_m - N_{m+t}}{D_m}, \quad 1 + a_{m_{t-1]}} = \frac{N_{m-1} - N_{m+t-1}}{D_m};$$

and therefore, $P_{m_t}] = r - \frac{N_m - N_{m+t}}{N_{m-1} - N_{m+t-1}} ;$

which is the formula given by Jones in Art. 200. When there are two lives, m, n , the formula is perfectly analogous.

Thus, $a_{m.n_t}] = \frac{N_{m.n} - N_{m+t.n+t}}{D_{m.n}},$

$$1 + a_{m.n_{t-1]}} = \frac{N_{m-1.n-1} - N_{m+t-1.n+t-1}}{D_{m.n}} ;$$

whence, $P_{m.n_t}] = r - \frac{N_{m.n} - N_{m+t.n+t}}{N_{m-1.n-1} - N_{m+t-1.n+t-1}} .$

The calculation of the premium by this formula presents no more difficulty than the corresponding one for a single life. Of course, in the case of a single life, it is preferable to use the formula,

$$P_{m_t}] = \frac{M_m - M_{m+t}}{N_{m-1} - N_{m+t-1}},$$

when the column M is formed. This formula is seen to be identical with the former by means of the relation $M_m = rN_{m-1} - N_m$. The analogous formula for two joint lives is not available, because the column M is seldom or never calculated for two lives.

It is easily seen that the analogous formulæ for the annual premium for an assurance for the whole term of a single life, or of two joint lives, are—

$$P_m = r - \frac{N_m}{N_{m-1}}, \quad P_{m.n} = r - \frac{N_{m.n}}{N_{m-1.n-1}} .$$

These however will never be required in practice, since Orchard's Tables afford a simpler way of obtaining the annual premiums, viz., by deducing them from the tabulated values of the annuities.

In conclusion, I may remark, that it is a little singular Jones has not adapted the formulæ for joint life annuities and assurances to the Commutation (or D and N) Tables, while he has done so with the much more complicated formulæ for survivorship assurances.

I remain, Sir,

Your obedient Servant,

T. B. SPRAGUE.

Liverpool and London Insurance Company,
20, Poultry, London,
7th September, 1858.

THE
ASSURANCE MAGAZINE,
AND
JOURNAL
OF THE
INSTITUTE OF ACTUARIES.

On the Determination of the Rate of Interest of an Annuity.
By PROFESSOR DE MORGAN.

THIS subject, as it left the hands of Simpson, Halley, Dodson, &c., is fully discussed in the appendices of Francis Baily's work on interest and annuities. These, with Milne's note on the subject (vol. ii., p. 680), Jones's notice of the problem, and the various modes of approximation announced in the pages of this *Journal*, give all I have found written about the matter in modern times. Referring to the citations in Baily for the history of the question subsequent to 1680, I give what I have found in previous time; and I add a few new formulæ for consideration. The problem is, I doubt not, of infrequent occurrence. It never occurred to myself to want more than a look at the tables would furnish; but it may be suspected that, as the requirements of business become closer, inverse problems will acquire more importance than they now possess.

Given the term, and the present value or the amount, of an annuity, immediate or deferred, required the rate of interest. The earliest notice I find of any case of this question is in the work*

* *The Scale of Interest*; or, the use of decimal Fractions, and the Table of Logarithmes, in the most easy and exact Resolving of all Questions in Anatocism, or Compound Interest, . . . together with their use in the measuring of board, timber, . . . for the use of the intended English Mathematical and Grammar School at Ross in

of Dr. John Newton, whose writings, announced or referred to as those of "I. Newton," sometimes puzzle indifferent chronologists by their dates. It was believed and stated, at the time, that all that was new in this book was an unacknowledged communication from Michael Dary, presently spoken of. The problem—described (p. 103) as "one of which Mr. Brigges hath made no mention"—of the rate to a given term and present value, is solved by common interpolation, on a seven years' instance, at five years' purchase, with an answer 9·2107 per cent.

The next who attempted the problem is Michael Dary, a writer who deserves to be rescued from the utter oblivion into which he has fallen, for which the publication of the *Macclesfield Correspondence* furnishes the means (i. 99, 179, 204, 220; ii. 16, 166, 176, 200, 239, 272, 296, 361, 365, 367, 369, 454, 456, 473, 479, 556). These references are rendered necessary by the *Macclesfield Correspondence* having, as yet, no index whatever, no table of contents, and not even a list of the writers.

Michael Dary turns up in 1663 as a correspondent of Collins, being then a gauger at Bristol, by Collins's interest, as he intimates. He appears with a ready knowledge of the higher mathematics—of indivisibles, for example. By 1673, we find him in London, "very poor and void of employment"; and then seeking, without success, for what appears to have been the mastership of the Royal Mathematical School at Christ's Hospital, with a testimonial from Newton, and the good offices of Collins. But he had obtained, a month or two before, the post of gunner in the Tower; and in 1677 he is described as a tobacco-cutter: Wallis calls him "Dary the tobacco-cutter, a knowing man in algebra." Among his patrons were Jonas Moore; Sherburne, the translator of Manilius; and George Wharton, the royalist astrologer. Among his correspondents were Collins, James Gregory, and Newton, from all of whom letters to him are preserved. There is also a letter from him to Collins in the Museum, published by the Historical Society of Science. After giving an equation, it runs as follows:—

"Mr. Collins,—I have been lately trying to break biquadratique equations into two quadratique ones, and I have effected my purpose in a great many, some by the aliquote parts, and some by the cubicall mant, but this soure crabb I cannot deal with by no method Your servant,

"MICHAEL DARY.

"*Tower, the 8th February, 1674-5.*"

Herefordshire. Also, a direction for Deans and Chapters in their Letting of Leases and Taking of Fines. By John Newton, D.D., and one of His Majesty's Chaplains. . . . London, printed for Dixy Page . . . and Allen Bancks . . . 1668. 8vo.

August 15, 1674, Dary forwarded to Newton the theorem, or a case of it, of which I shall presently speak, in a letter beginning—"Although I sent you three papers yesterday, I cannot refrain from sending you this. I have had fresh thoughts this morning" The letter ends with—"Sir, pray do not count me troublesome, for I could not forbear but send this by Stiles,* the carrier, who is paid for the carriage. Pray remember me about the series of logarithms." No wonder that Newton, two months afterwards, writing to Collins, should say, "Mr. Dary is very solicitous about mathematics."

Dary published two works—one of *Miscellanies*, before 1673, which I have never seen; the other,† the *Interest Epitomised*, which is now very rare. The work is described in the *Correspondence* as about to be printed at the author's expense, for want of "undertakers;" but, by the dedication, it appears that the expenses were paid by Jonas Moore, Sherburne, Wharton, and James Hoare, Jun.—the last the only one of the four whose name has not descended. This work contains the theorem, above described as sent to Newton, which is now one of considerable importance in the calculus of functions, though I am not aware that it has ever been attributed to its first discoverer. It is as follows:—If a certain function, ϕ , be used as follows, $b = \phi a$, $c = \phi b$, $d = \phi c$, &c., then, if ϕa , ϕb , ϕc , &c. do not increase without limit, but approach to either a finite or zero limit, that limit is a solution of the equation $x = \phi x$. Dary applies this, *inter alia*, to the question of finding the rate of interest, as follows: If $ar = 1 - (1 + r)^{-n} = 1 - v^n$, where n is the term of years, r the rate per pound, and a the purchase of the annuity of £1, then, if $(1 - v^n) \div a$ be calculated by an approximate value of r , the result is a *nearer* value of r , which may be used in the same way to get a still nearer value; and so on. This is the first genuine solution; and, as the problem wants a name, I propose to call it *Dary's problem*. The approximation converges but slowly, and the method should only be used when an *inferior* value is commenced with, and it is desired to find a *superior* value also. Let r_1 be an inferior value of commencement, from which r_2 and r_3 are found by the method; then

* John Stiles, the Cambridge carrier, is a person of note in the *Macclesfield Correspondence*. He takes the books backwards and forwards, returns with the money, and his name is a household word in the correspondence between Cambridge and London. He might have said to Newton, *Ubi tu Jupiter, ego Mercurius*.

† *Interest Epitomised, both Compound and Simple*. Very useful for every one that lendeth or borroweth; and for Purchasing and Selling of Annuities or Pensions, and Leases in Reversion. Whereunto is added, a Short Appendix for the Solution of *Adjected Equations* in Numbers by Approachment: performed by Logarithms. By Michael Dary, Philomath. London: Wm. Godbid, 1677. 8vo.

$r_3 + \frac{(r_3 - r_2)^2}{(r_2 - r_1) - (r_3 - r_2)}$ is a *superior* value, and nearer than r_3 . The method converges more rapidly when we commence with a superior value; but the last formula does not then give an inferior value.

Newton himself gave a hint towards the solution of the problem, in reply to an inquiry of Collins, which seems to have been made on the part of Dary. In a letter to Collins (Feb. 6, 1669-70, *Macclesfield Correspondence*, vol. ii. p. 287), Newton writes as follows:—

“To know at what rate (N per cent.) an annuity of B is purchased for 31 years at the price A.

$$\text{The rule is, } \frac{6 \log. \text{ of } \frac{31B}{A}}{100 - 50 \log. \text{ of } \frac{31B}{A}} = \log. \text{ of } \frac{100+N}{100}.”$$

Newton then works an example, $B=100$, $A=1200$, and deduces $N=7.43$. He then proceeds as follows:—

“This rule is not exact, but yet so exact as never to fail above 2*d.* or 3*d.* at most, when the rate is not above £16 per cent. And if the rate be above £16 or £18 per cent., or, which is all one, if $A < 6B$, then this rule, $\frac{A+B}{A} = \frac{100+N}{100}$, will not err above 2*s.* You may try the truth of

these rules by the equation $X^{32} = \frac{A+B}{A} X^{31} - \frac{B}{A}$, putting $\frac{100+N}{100} = X$, and working in logarithms.”

In a subsequent letter (Feb. 18) Newton adds:—

“The solution of the annuity problem, if it will be of any use, you have my leave to insert it into the *Philosophical Transactions*, so it be without my name to it. For I see not* what there is desirable in public esteem, were I able to acquire and maintain it. It would, perhaps, increase my acquaintance, the thing which I chiefly study to decline. Of that problem I could give exacter solutions, but that I have no leisure at present for computations.”

I cannot find that this method was published: had it been in print, I cannot doubt that Halley, whose formula is closely connected with this, would have preferred a direct logarithmic form. If we take two terms of $2+t+\&c.$, in the formula presently given, remembering that $2+t=2(1-\frac{1}{2}t)^{-1}$ nearly when t is small, we have the *form* preferred by Newton. This will give

$$\log. (1+r) = \frac{6 (\log. n - \log. a)}{3(n+1) - \frac{n-1}{2} \log. n - \log. a},$$

.4342945

* This is, I believe, the earliest manifestation now known of the temperament which afterwards put the world in some danger of never knowing Newton's discoveries.

which is the *form* of Newton's result, B being unity, and A being a . But if $n=31$, this gives 96, and 34.5 in lieu of 100 and 50. I suppose that Newton roughly amended the coefficients, so as to make the result more accurate for the high rates of interest than in use, and less accurate, relatively, for the lower ones. Perhaps, deriving the form from general considerations, as an approximation representing two terms of the series for $\log. (1+r)$, he determined the coefficients 100 and 50 by comparison with tables or results. From the letters cited, it seems that Newton expanded the logarithm of a root of any binomial equation, and that this expansion was the "series of logarithms" about which Dary inquires.

Taking the hint of the form of expansion from Newton, I find the following results by common methods:—

Let r be the interest of £1 for one year, n the number of years of an annuity payable yearly, and a its present value. Given a and n , required r .

$$\text{We have, } a = \frac{1 - (1+r)^{-n}}{r}. \quad \text{Let } t = \frac{1}{3} \frac{n-1}{n+1} \frac{\log. n - \log. a}{.4342945};$$

$$\text{then, } \log. (1+r) = \frac{\log. n - \log. a}{n+1} \cdot \left\{ 1 + \frac{1}{1-t} - \frac{1}{20} \frac{t^3(1+t)}{(1-t)^2} \right\}.$$

Let A represent the accumulations of the same annuity at the moment after the last payment. We have

$$A = \frac{(1+r)^n - 1}{r}. \quad \text{Let } t = \frac{1}{3} \frac{n+1}{n-1} \frac{\log. A - \log. n}{.4342945};$$

$$\text{then, } \log. (1+r) = \frac{\log. A - \log. n}{n-1} \cdot \left\{ 1 + \frac{1}{1+t} + \frac{1}{20} \frac{t^3(1-t)}{(1+t)^2} \right\}.$$

The following formula is not calculated to the same extent:—
Let the annuity be deferred for m years, let a be its present value. We have then—

$$a = \frac{(1+r)^{-m} - (1+r)^{-n}}{r}. \quad \text{Let } t = \frac{1}{3} \frac{n^2 - 1}{(2m+n+1)^2} \cdot \frac{\log. n - \log. a}{.4342945};$$

$$\text{then, } \log. (1+r) = \frac{\log. n - \log. a}{2m+n+1} \cdot \left\{ 1 + \frac{1}{1-t} - \frac{1}{20} t^3 \right\};$$

I suspect that, as before, $\frac{t^3(1+t)}{(1-t)^2}$ would be more accurate than t^3 ; but I have not proved it.

I owe the following verifications to my friend Mr. Peter Gray; the rate is 5 per cent., and the values of a given by the common table are used, which of course ought to give $r=.05$:—

n .	Baily.	De Morgan.
10	·05000	·05000
25	·05003	·05001
50	·05019	·05004
75	·05060	·05014
100	·05140	·05019

At 10 per cent., $n=21$ gives ·1001, and $n=100$ gives ·1063. I doubt if any other formula of the kind yet given has borne the test of 10 per cent.

The following is Mr. Gray's way of arranging the calculation, $n=100$, $a=19\cdot84791$:—

Log. n	.	.	2·000000	
Log. a	.	.	1·297715	
<hr/>				
Log. $n - \log. a$	.	.	·702285	$\overline{1}\cdot846514$
$n+1$	.	.	.	$2\cdot004321$
<hr/>				
(Log. $n - \log. a$)($n+1$) ⁻¹	.	.	.	$\overline{3}\cdot842193^*$
$n-1$	.	.	.	$1\cdot995635$
($3 \times \cdot4342945$) ⁻¹	.	.	.	$\overline{1}\cdot885094$
<hr/>				
t	.	.	·528350	$\overline{1}\cdot722922$
$1-t$	.	.	·471650	$\overline{1}\cdot673620$
($1-t$) ⁻¹	.	.	2·12021	$0\cdot326380$
<hr/>				
t^3	.	.	.	$\overline{1}\cdot168766$
$1+t$	.	.	1·528350	$0\cdot184223$
($1-t$) ⁻²	.	.	.	$0\cdot652760$
20^{-1}	.	.	.	$\overline{2}\cdot698970$
<hr/>				
Product of last four	.	.	·05067	$\overline{2}\cdot704719$
$1+(1-t)^{-1}$	.	.	3·12021	
<hr/>				
			3·06954	$0\cdot487074$
<hr/>				
				$\overline{3}\cdot842193^*$
<hr/>				
Log. ($1+r$)	.	.	·021344	
$1+r$	.	.	1·050185	$\overline{2}\cdot329267$
True answer	.	.	1·050000	

In the formula for r from A, taking data which ought to give $r=\cdot05$, Mr. Gray finds ·05083, ·05001, ·04989, ·04993, ·04971, at 10, 25, 50, 75, 100 years. At $n=100$, when r should be ·1, it is ·09146.

The following direct approximations are not quite so good as the one which has been given. Let $z = \frac{2(n-a)}{n(n+1)}$,

$$r = z + \frac{n+2}{3}z^2 + \frac{(n+2)(5n+7)}{36}z^3 + \frac{(n+2)(17n^2+44n+29)}{270}z^4,$$

$$\frac{r}{1+r} = z + \frac{n-1}{3}z^2 + \frac{(n-1)(5n-2)}{36}z^3 + \frac{(n-1)(17n^2-10n+2)}{270}z^4.$$

At 10 per cent., and 100 years, these give $r = \cdot 09$. The second of these series, though very differently obtained, is a particular case of that given by Mr. James Meikle in this *Journal*, vol. v., p. 153. The co-efficients in the page cited, which are the common co-efficients obtained in the reversion of series, are quite correctly printed in the last two lines (the value of d): five more may be found, with a difference of notation easily reduced, in the article "Reversion of Series," in the *Penny Cyclopædia*.

All the preceding formulæ require no assistance from tables. The following will give, I think, better results than any I have seen in which an approximate answer is chosen directly from the table:—

Let a and n be as before, and let a' be the nearest to a in the tables, above or below; the rate per pound for a' being r , the approximate value. Take v^{n+1} and v^{n+2} from the table of present values, and calculate $(a' - a)r = p$, $a - nv^{n+1} = q$. Then calculate ρ from

$$\rho = \frac{p}{q + n \frac{n+1}{2} \frac{pv^{n+2}}{q}},$$

and $r + \rho$ is a much nearer approximation. I have put down the form which I find most easy to calculate; but every one must please himself in this respect. Taking $n = 98$, $a = 21 \cdot 924788$, I find $a' = 24 \cdot 464607$, $r = \cdot 04$, and $\rho = \cdot 00498$, whence $r + \rho = \cdot 04498$; which should be $\cdot 045$. This is a severe test for the formula, both as to n and ρ . The second term of the denominator is generally small compared with the first: reject it, and the remaining formula is, in substance, that given in Mr. David Jones's work.

The following formula is formed by carrying the method of the preceding still further:—Let a' , as before, be the table result at the rate r ,

$$\begin{aligned} p &= (a' - a)r, \\ q &= a - nv^{n+1}, \\ k &= n(n+1)v^{n+1}, \\ s &= k + \frac{n+2}{3}q, \end{aligned}$$

$$\rho = \frac{p}{q} \left\{ 1 - \frac{kt}{2} (1 - st) \right\}.$$

$$t = \frac{vp}{q^2},$$

$$\text{Rate required} = r + \rho.$$

When $n = 100$, $a = 9 \cdot 5233704$, the result is $r = \cdot 10$, $r + \rho = \cdot 10499991$, and should be $\cdot 105$.

On the Rates of Interest for the use of Money in Ancient and Modern Times. Part III. By WILLIAM BARWICK HODGE, Vice-President of the Institute of Actuaries.

[Read before the Institute, 27th Dec., 1858, and ordered by the Council to be printed.]

THE steady and gradual diminution in the rate of interest that took place from towards the end of the sixteenth to the middle of the eighteenth century, was generally attributed, during the period, to the great additions made, after the discovery of America, to the amount of gold and silver circulating in Europe.

It is rare to find any grounds stated for this opinion, which appears to have been received, without much inquiry, as a self-evident proposition. Among those who asserted it was the sanguine projector John Law;¹ but he does not seem to have thought that it required any proof.

Montesquieu, indeed, endeavoured to adduce evidence in favour of it, but did little more than assert that, from the large sums of money brought to Europe, there must have been fewer people wanting to borrow;² and, although he referred to the great proportionate rise in prices, he left entirely out of consideration the fact that, as soon as transactions were settled upon the new basis, the increased cost of the commodities that were the objects of trade would render necessary an increase of capital to carry it on, and a corresponding increase in the sums required as loans.³

He certainly quotes the assertion of a native American historian, the Inca Garcilasso,² that, immediately after the discovery of America, the rate of interest in Spain fell from 10 to 5 per cent. per annum; and this, if authentic, must be admitted to be in favour of his views.⁴

Hume was the first person to question this opinion, as to the effect of the increase of the precious metals; and his desire to

¹ *Econo. Financ. du 18^e Siècle*; Paris, 1841; p. 667.

² *Esprit des Lois*, liv. xxii. chap. 6.

³ The following estimates of the amounts of the precious metals circulating in England and Wales at different periods, are given by Dr. Charles Davenant (*Works* i. 369):—

1590	£4,000,000	1688	£18,500,000
1624	£5,500,000	1697	£16,036,000
1660	£14,000,000		

⁴ Montesquieu has been accused of asserting facts upon doubtful authority when they appeared to support his opinions. The historian he refers to is not mentioned in the list of writers prefixed to Dr. Robertson's *History of America*; and his works appear to have been unknown to Hume, who, in the *Essay upon Interest*, confounds him with the Spanish poet, Garcilasso de la Vega.

refute it appears to have been his principal inducement for publishing the *Essay on Interest*, A.D. 1752. Adam Smith¹ considered he had settled the question so completely, as to render the further discussion of it unnecessary. Nevertheless, we frequently hear a similar error repeated at the present day; and a recent publication, of considerable ability and research, contains a warning as to the effect the discoveries in California and Australia are likely to have in diminishing the rate of interest.²

One great source of fallacy upon the subject has been the confusion arising from assigning the same term to two very different ideas. The value of money is an expression not only applied commonly to the exchangeable value of gold and silver, or the proportion of commodities that a given weight of one of those metals will command, but is used likewise to denote the rate of remuneration for which loans can be obtained. It is universally admitted, that an increased supply of the precious metals has a tendency to reduce the value of money in the former sense; and the admission has been, without consideration, assumed to apply to it in the latter; but so far from there being any evidence that such increased supply tends inevitably to diminish the rate of interest, the only experience we can refer to upon the subject leads to a contrary conclusion.

The discovery of large accessible quantities of gold in California and Australia caused, in both countries, an enormous depreciation in the value of the metal, or, which is the same thing, an enormous rise in the prices of commodities; but it caused an equally enormous rise in the rate of interest, which reached at the gold diggings in each country as high as 20 per cent. per annum. There is no doubt that the stimulus to trade caused by the gold discoveries, led recently in England to a rate of interest upon commercial transactions higher than had been known for many years before. The real cause of the fall in interest that has been considered, was, indisputably, the great change that took place in the social condition of the principal European nations. It was only about the period of the discovery of America that those nations attained the advantages of tolerably regular and orderly governments, that the power of the feudal nobility was restrained, and the right they assumed of carrying on private wars effectually repressed.

Up to that time, the general insecurity had the effect of keeping

¹ *Wealth of Nations*, book ii., chap. 4.

² *Insurance Guide and Handbook*; Lond., 1857; p. 196.

up the rate of interest, not only by increasing the risks of the lenders, but by discouraging the accumulation of capital.

It has already been pointed out,¹ that the prohibition of usury, by compelling secrecy in all such transactions, has prevented any extensive information coming down to us as to the rates at which they were negotiated.

A similar difficulty arises out of the laws regulating the rate of interest; for as the prohibition, however strict the attempts to enforce it, was never successful in preventing the practice, we readily infer that the legal limitations were similarly evaded.

For these reasons, we are unable to determine whether the rate of 10 per cent., fixed by the 37th Henry VIII. and the 13th Elizabeth, was in accordance with the market rate during the periods those Acts were in force.

Macpherson supposed this rate to have been adopted, in the former Act, on account of its being the one that was current at the time in Genoa, which city, he states, was then the chief seat of bankers and dealers in money, and regulated, in a great measure, the rate of interest throughout Europe.² The Bank of St. George, at Genoa, was one of the earliest establishments of that description.³ It made large advances to both the Spanish kings, Charles V. and Philip II.; and the latter must have been seriously dependent upon it for supplies, if we are to believe the assertion of Bishop Burnet, that Sir Thomas Gresham delayed for a year the sailing of the Spanish Armada by causing a run upon this bank, and thereby preventing it from advancing the funds necessary for the expedition.⁴

On the accession of Charles IX. of France, about the same period, A.D. 1560, the interest paid upon the public debt of that kingdom, amounting to 43,483,000 livres, was 12 per cent., as appears from a financial statement submitted to the States-General, A.D. 1561;⁵ but not long afterwards, A.D. 1601, Henry IV., by a royal edict, reduced the legal rate to $6\frac{1}{4}$ per cent. At this latter date, the current rate in France appears to have been rather lower than in England; for Sully, the adviser of the reduction, relates, in his memoirs, that the ordinary charge was the twelfth penny, or $8\frac{1}{3}$ per cent., although some took as much as the tenth penny, or 10 per cent., then the legal rate in this country. The reasons assigned for the measure by this celebrated minister differ little from the

¹ *Assurance Mag.* vi. 328.

² *Hist. Comm.* ii. 103.

³ Hallam: *Hist. Middle Ages* ii. 404. ⁴ *Hist. of his own Times*; Lond., 1838; p. 209.

⁵ *Hist. of the Reformation*; Lond., 1847; i. 222.

views that have been described as being popular here at the same time; and he particularly insists upon the tendency of high interest to reduce the value of land, the only wealth of the nobility.¹ The royal edict declared it had ruined many good and ancient houses, and obstructed commerce, tillage, and manufactures.²

Hume³ and Macpherson² both describe this as a reduction to $6\frac{1}{2}$ per cent.; but Sully expressly states that the twelfth penny was forbidden, and the sixteenth penny, which is $6\frac{1}{4}$ per cent. only, was substituted. The writer first-mentioned cites this as an indication of the great advance of France above England in commerce,³ which it certainly was, if the legal agreed with the market rate, but this seems doubtful.

There is sufficient evidence, that in England, under the 5th and 6th Edward VI., which altogether forbade the taking of interest, considerably more than 10 per cent. was paid. It has been mentioned, that Queen Mary was compelled to borrow at 12 per cent.;⁴ and Dr. Wilson, whose book was published in her reign, reproaches the usurers with bringing the Prince behind-hand by taking twelve and fourteen in the hundred.⁵ The same writer, while admitting the Jews were worthily banished from England for their usuries, thus complains of the money-lenders of his time:—"They are worse than Jewes, for go whither you will throughout Christendome, and deal with them (the Jewes), and you shall have under ten in the hundreth—yea, sometimes for six—at their handes, whereas English usurers exceed all God's mercies, and will take they care not how much"⁶—and one of the parties to the dialogue, in pointing out the impolicy of forbidding usury, urges—"See what cometh of this precise restraint: men can now get no money but after thirtie or twentie, at the least, in the hundred."⁷

From this work we obtain information as to the rates charged upon loans of small sums.

Dr. Wilson says—"This learning is now so well known, that even women, yea, and goodman hoyden from the countrie, in whom a man would thinke were no craft or subtletie to live, can aske the shilling pennie for a week, which in a yeere amounteth to four shillings and four pence;"⁸ and, pointing out that it is equal to 400 per cent., he denounces it as "marvellous strange and uncharitable."⁸ His indignation would have been greater had he known the fact that £100 invested in this manner, if the interest

¹ *Memoirs*; Paris, 1814; iii. 6.

² *Hist. Comm.* ii. 223.

³ *Hist. Eng.*; Appendix, No. 3.

⁴ *Assurance Mag.* vi. 332.

⁵ *Dialogue*, &c., p. 78.

⁶ *Ibid.*, p. 38.

⁷ *Ibid.*, p. 51.

⁸ *Ibid.*, p. 15.

were regularly received and re-invested at the same rate, would amount in a year to £6,421.5s., making the interest equivalent to upwards of 6,000 per cent. paid yearly.

The following stanza occurs in a ballad of the time intitled *Gernutus the Jew*:—

“His wife must lend a shilling,
For every week a penny;
Yet bring a pledge that is double worth,
If that you will have any.”¹

and a century afterwards, A.D. 1686, the shilling penny by the week was commonly taken from fishwives and dealers in small wares.²

High as it seemed to Doctor Wilson, this rate is much exceeded by charges made at the present day, notwithstanding the great accumulation of capital that has taken place since his time.

We are told by the author of *London Labour and the London Poor*, that the ordinary charge for loans to the costermongers, or itinerant vendors of fish, vegetables, and so forth, in the metropolis, is 20 per cent. for a week; which, at simple interest, is equal to £1,040, and at compound interest, to £1,310,356 per cent. per annum.³ Among the people described, 10 per cent. for a week⁴ is reckoned extraordinarily low interest, and instances are given of as much as 50 per cent. paid for a single day.⁵ One man assured the writer in question that he had paid sixpence a day for a month, or fifteen shillings in all, for the loan of five shillings, which he repaid at the end of the term.⁶

The lender, in this case, quadrupled his capital in a month;

¹ *Percy Reliques*, &c.; Lond., 1839; p. 56.

² Kelly: *On the Usury Laws*, p. 13.

³ Mayhew's *London Labour*, &c.: Lond., 1851; i. 29.

⁴ I have already given a table for comparing monthly with annual payments of interest (*Assurance Magazine* vi. 304). The following table has been constructed upon precisely the same principles for the comparison of weekly with annual payments. The results are given up to 1 per cent. for a week to the nearest fraction of one eighth above that rate to the nearest whole number.

Rate payable Weekly.	Nominal Rate payable Annually.	Actual equivalent Rate payable Annually.
$\frac{1}{4}$	13	137
$\frac{1}{2}$	26	293
$\frac{3}{4}$	39	471
1	52	673
2	104	180
3	156	365
4	208	669
5	260	1,164
10	520	14,104
20	1,040	1,310,356

⁵ *London Labour*, &c., i. 30.

⁶ *Ibid.*, i. 31.

and, if he could have invested a sovereign in a similar manner, re-investing its accumulations at the end of each month at the same rate, it would have amounted, in one year, to sixteen millions, seven hundred and seventy-seven thousand, two hundred and sixteen pounds! ¹ If he could have continued the operation for fifteen months, he might have paid off the National Debt, and had nearly three hundred millions to spare!

In reference to such transactions, it must be considered that the real interest of money forms but a small part of the remuneration received by the lender, which consists, in addition, partly of the fund necessary to replace losses, but principally of wages for the labour incurred in carrying on a number of small transactions of a very troublesome character. The demand, too, for money at such rates can hardly be otherwise than irregular and uncertain; and as the lender must always be in readiness to take advantage of the market, his capital probably often lies idle.

We may be sure, that if such high rates of profit could be looked for upon an extended scale with any degree of certainty, capital would flow into the trade; although it must be admitted, that as no one could carry on such a business successfully without an intimate acquaintance with the characters and habits of the persons he dealt with, this knowledge might have the effect of giving the person possessing it a kind of monopoly.

A capital of £150 so employed appears to be considered unusually large; and the estimated gains of its proprietor—£390 a-year ²—if they even equal that sum, are probably not such as to tempt many persons to compete in a business of the kind; neither is it easy to believe the story told by the author of a legal work, that, in the last century, the father of a peer amassed a large fortune by such investments. ³

We find a striking proof of the heavy charge made in these cases to cover bad debts, in the fact that, while the weekly hire of a barrow which costs £2. 12s. is only from one shilling and sixpence to two shillings, ⁴ the interest required for the loan of £2. 12s. for a week is from five to ten shillings, although the barrow is an article likely to be deteriorated by use. The reason for this is clearly that the facilities for dishonesty, as well as the temptations to it, are much greater when money is the subject of the loan.

It has been customary to speak of the interest of money as divided into two parts,—the one being the compensation received

¹ $(1 + r)^{12} = (1 + 3)^{12} = 16,777,216$.

³ Kelly: *On the Usury Laws*, p. 13.

² Mayhew i. 31.

⁴ Mayhew i. 30.

for foregoing the use of the capital lent, the other the premium covering the risk of its loss; but there is another element, sometimes an important one, namely, the expense of carrying on the business of lending.

Pawnbrokers in England are entitled to charge, as interest, 20 per cent. upon sums not exceeding £2. 2s., and 15 per cent. upon greater amounts up to £10; but the slightest reflection on the nature of their business will show, that a large portion of the money so received must be required to meet charges for warehouse rent, wages of labour, and so forth. The annual expenses of the Monte di Pietà at Rome are £6,081. 12s. 4d., exclusive of pensions to retired officers.¹

The charges attending loans may be occasionally considered as forming part of the premium against risk. Thus, a man borrowing £1,000 upon mortgage of a freehold estate, would probably have to pay not less than £40 as the legal expenses of the security, and would actually receive only £960.

If the rate of interest agreed upon were 4 per cent., he would be liable to pay annually £40, or £4. 3s. 4d. per cent., for that sum; and, on redeeming the mortgage, to repay the full £1,000, with, perhaps, £10 further costs. The effect of these charges upon the rate interest would depend upon the duration of the loan. Assuming this to be five years, the additional payment would be equivalent to interest at $(1.021=)$ £1. 0s. 5d. per cent. per annum, the rate at which £960 will amount to £1,010 in five years. Thus, while the lender would only have received 4 per cent., the borrower would have paid £5. 3s. 9d. per cent.—the difference being, in this case, the premium to cover the risk of the lender, who, but for the species of assurance obtained by the legal investigation, would probably have required a much higher interest. If the loan were for one year only, the rate of the actual cost to the borrower would be £9. 7s. 6d.; and if for six months, £14. 11s. 8d. per cent. per annum; the lender still receiving only at the rate of 4 per cent.

This is one of the cases that show the absurdity of fixing any legal limit to interest, as it is clear that a borrower wishing to obtain a loan for a few months might find it advantageous to pay a high rate of interest under an arrangement that did not involve him in expenses.

There is only one thing certain with respect to loans of money, the lender can never receive more than he stipulates for. That he

¹ *Statistical Journal* iv. 351.

often may, and does, receive less, is, doubtless, within the knowledge of most persons. It follows that, upon any considerable number of such transactions, there must almost inevitably occur a certain percentage of loss, however small it may be. To determine the average ratio of this would be an exceedingly interesting branch of the present inquiry; but it could only be done by investigating the records of large establishments, engaged in operations of the kind through a long series of years. I have heard it stated of one of the oldest Insurance Offices in London, that its losses in this respect, from the first commencement of its business, would have been covered by an annual charge of ($0.050 =$) one shilling per cent. upon the average amount of capital invested; but the only authentic information of the kind published, I believe, is to be found in the Appendix to the Report upon the Bank of England, made by a Committee of the House of Commons in August, 1832.¹ This Appendix contains a Table (No. 59) of the annual average amount of commercial paper under discount at the Bank, from the year 1795 to 1831 inclusive, and a Return (No. 60) of the annual average loss from bad debts arising out of discount transactions in the same period.

From a comparison of the facts there given with the rates of discount actually charged, it may be deduced that the average amount under discount at the Bank, during the thirty-seven years referred to, was £7,507,935; that the gross amount of discount received was £13,703,578; being an annual average of £370,367, or ($4.933 =$) £4. 18s. 8d. per cent. upon the capital invested. The average annual loss is stated at £31,696, being ($0.42217 =$) 8s. $5\frac{1}{4}$ d. per cent. upon the capital, or ($8.555 =$) £8. 11s. 2d. per cent. upon the interest received. The net rate of the latter was, therefore ($4.511 =$), £4. 10s. $2\frac{3}{4}$ d. per cent.; and if we knew precisely the expenses of this department of its business, we should be able to determine the exact amount of profit that accrued to the Bank therefrom.

The violent controversy as to the lawfulness of taking interest at all, had not long been finally settled, when another arose as to the policy of diminishing the legal rate, which was carried on, with hardly less vehemence, during the greater part of the seventeenth century.

One of the originators of the movement appears to have been Sir Thomas Culpepper the Elder, who printed in London, A.D. 1621, *A Tract against Usurie, presented to the High Court of Parliament*,

¹ *Parl. Papers*, 1833, No. 76.

subsequently reprinted by Sir Josiah Child in 1693. This pamphlet, published anonymously, was ascribed to Sir Thomas by his son, in the preface to a work on the same subject published in 1668.

Although, like so many of his contemporaries, entertaining very mistaken views respecting interest, the writer was evidently a person of great sagacity, who stated his opinions with remarkable clearness; and he hit upon the true principle by which borrowing should be governed, when he pointed out that the stock of (*i.e.*, the capital invested in) woods would grow faster at ten in the hundred than the woods themselves.¹

His principal object seems to have been to make capital more plentiful for the encouragement of agricultural improvements, and in his views respecting them he appears to have been in advance of his time. "Then," says he, "would all the wet lands in the kingdom soon be drained, the barren lands mended by marle, sleet lime, chalk, sea-sand, and other means, which, for their profit, men's industry would find out."²

Culpepper's pamphlet was evidently published with the intention of assisting a great parliamentary effort, made in the same year, (1621) to reduce the legal rate of interest from 10 to 8 per cent., which had been unsuccessfully attempted both in 1606³ and 1614.⁴

The measure was not passed, but it excited extraordinary attention; and a concise report of the debate upon it in the House of Commons was entered on the *Journals*—a course usual at the period in reference to matters of importance. This report stands in remarkable contrast to the floods of words that now inundate the columns of the daily papers during the session of Parliament; and, as it contains authentic evidence of the opinions held at the period, I here insert it:

Lunæ 7^o Maii 19^o Jacobi (1621).

L 2^a. AN ACT FOR THE ABATEMENT OF USURY.

"Sir Edward Mountague,—Against the Bill—For alloweth Usury, which not allowed by the Law, or Church of England.

"Sir George Moore, contra; So Sir H. Poole,—This alloweth not, but restraineth only from Ten to Eight—To have the Penalties may be recovered,—

"Mr. Mynn:—To commit the Bill, and insert something against Brokage,

"Mr. Prowse:—This Bill formerly cast out; Unfit now. The time shorter for taking in of Money: May much distress both Gentlemen and Merchants.

"Mr. Whitson, — Against the Bill—against the Provision for not selling Wares for time at above eight per cent.

¹ Page 6.

² Page 8.

³ *Commons' Journals* i. 290.

⁴ *Ibid.*, i. 303.

“Mr. Guy :—To have consideration of Mortgages, where the time not yet come.

“Sir Edward Sackvyle :—Doubteth, the Bruit of this Bill may do much Hurt ; and undo those men which owe money.—Dutch Money.

“Dr. Gooch :—Usury condemned in all Commonwealths ; yet but weakened, not taken away,—Doubteth, thus abating it will take it away.—That this will undo most of the Gentry of England : Will bring down the Price of Land. No Man will lend Money and so many Mortgages may be lost.

“Mr. Neale—accordant :—Yet thinketh this may be helped at the Committee.”¹

The Bill was committed, and on the 29th May reported and ordered to be engrossed ;² but the further proceedings appear to have been stopped by the termination of the session, which took place a few days afterwards.

It seems to me not improbable, that the arguments subsequently embodied by Bacon in his *Essay on Usury* were originally prepared for the discussion of this Bill, in which he would probably have been expected to take a prominent part. However, it never reached the House of Lords ; and, ere it could have done so, Bacon's voice had been heard there for the last time—this being the session that saw his miserable fall, so deeply mourned by the admirers of his genius, because so well deserved.

The reduction contended for was finally effected in the year 1624, when it was enacted by the 25th Jac. I., cap. 17, that from and after the 24th June, 1625, all contracts for the payment of a higher rate than 8 per cent. per annum should be void, and that every one receiving more than that rate should forfeit treble the value of the monies, wares, or merchandise lent. Moreover, that every broker, scrivener, solicitor, or driver of bargains, who, after the date mentioned, should receive more than five shillings for procuring the loan of £100 for a year, and so rateably, or above twelve pence for making or renewing of the bond or bill, should for every such offence forfeit twenty pounds, and suffer imprisonment for half a year.

Very faint opposition was made to the Bill in the Commons ; one member only urging, that it was likely to be injurious to trade, which it had always been the labour of the House to increase, and that the rate for money in Spain and Italy being much higher, our moneys would be carried thither. To which it was replied, that the reason we were beaten out of trade by the Lowcountry men was, because money was there six in the hundred.

¹ *Commons' Journals* i. 611.

² *Ibid.* i. 631.

The Bill was read a third time, and passed without any division. On its passage through the House of Peers, a curious scene occurred.

The Lord President reported it, on the 29th April, 1624, as fit to pass without any amendment, when the Lord Archbishop of Canterbury solemnly rose, and moved that the Judges might consider whether this Bill did not tacitly allow of usury to be taken (which is against the word of God); for that it then might be a scandal to our religion: and upon the Judges' report, that the Bill might be doubtfully interpreted in that sense, the Lords thought fit that a proviso should be added to the said Bill. The addition, which was "penned" by the Lord Keeper, with the assistance of the Lord President, was to the following effect:—"Provided no words in this law contained shall be construed or expounded to allow the practice of usury in point of religion or conscience;"¹ and the adoption of it appears to have been an especial comfort to some of their Lordships, particularly the Bishops, who boasted of it as disgracing usury.

The absurdity thus perpetrated by the Peers, under the guidance of the head of the church and the head of the law, was not without example; for the 13th Elizabeth, cap. 8, passed expressly to authorize usury not exceeding 10 per cent. per annum, recited as follows:—"And forasmuch as all usury, being forbidden by the law of God, is sin, and detestable."

The Journals recording the proceedings of the House of Lords respecting this latter Act are not published; but, from an entry in those of the Commons,² there seems little doubt this recital was introduced by their Lordships; a conclusion deriving confirmation from the fact, that it appears to be one of the enduring peculiarities of hereditary senators to stigmatize a principle as immoral and irreligious, while stamping it with the sanction of legislative enactment.

The Lord Keeper in 1624 was Williams, Bishop of Lincoln, who rose upon the ruin of Bacon, and was the last churchman that held the Great Seal. That the great body of the clergy still retained undiminished their hostility to usury, appears not only from the conduct of the bishops on the occasion described, but from the sermons of the time, which are full of invectives against the practice, and called forth the following remark from the celebrated John Selden, "Would it not look oddly to a stranger, that should come into this land and hear in our pulpits usury preached against and yet the law allow it? Many men use it, perhaps, some church-

¹ *Lords' Journals* iii. 325.

² *Commons' Journals* i. 87.

men themselves.”¹ From a subsequent Act, passed (A.D. 1651) for regulating the rate of interest, the House of Commons, by a special vote, ordered the omission of a clause stigmatising usury, couched in the same terms as that in the 21st Jac. I.² This latter Act was passed for seven years only, but was made perpetual (A.D. 1627) by the 3rd Charles I., cap. iv., sect. 5.

It had been enacted (A.D. 1586) by the Scottish Parliament, that the legal interest should not exceed ten pounds, or *five bolls of victual*, for £100 by the year;³ and, in 1633, they followed the example of the English legislature, and reduced the legal rate from 10 to 8 per cent.⁴

King James I. obtained (A.D. 1620) a loan of 200,000 dollars, at a yearly interest of 6 per cent., from his brother-in-law, Christian of Denmark,⁵ who accommodated him the following year with a loan of 100,000 dollars, at the same low rate;⁶ but his own subjects did not deal so liberally with him. Charles I., soon after his accession, acknowledged a debt of £27,000 to Sir William Courten, a celebrated merchant of that day, which bore interest at 8 per cent., and one-half of which had been contracted by James.⁷

Among the numerous expedients adopted by Charles to extricate himself from the pecuniary difficulties in which, from his hatred of parliamentary government, he became involved, he does not appear to have tempted advances by high rates of interest.

The forcible abstraction of money from his subjects seems indeed to have been more to his taste, and, according to his views, more profitable.

Soon after his abrupt and fatal dissolution of the Short Parliament (5th May, 1640), the necessity he was under of finding the means of repelling the attacks of his Scottish subjects, drove him to measures which far exceeded his earlier extortions.

The aldermen of London were summoned before the Privy Council, in order that they might designate the persons in their respective wards who were able to lend the king money, or, in other words, who had anything to be robbed of, which some of them refusing to do, were committed to prison.

These, whose names ought to be held in remembrance by every Englishman, were Alderman Somes, Alderman Atkins, Sir Nicholas Rainton, and Alderman Geare; and the warrants for their committal were signed, among others, by Strafford, by Laud, by the

¹ Selden's *Table Talk*; art., "Usury."

³ *Hist. Comm.* ii. 182.

⁶ *Ibid.* ii. 312.

⁴ *Ibid.* ii. 376.

⁷ *Ibid.* ii. 336.

² *Commons' Journals* vii. 575.

⁵ *Ibid.* ii. 303.

Lord Keeper Finch, and by Secretary Windebanke, 'all of them destined soon to become the victims of a severe and bitter retribution.¹

Charles descended to the wretched expedient of purchasing, upon credit, a large store of pepper existing in the hands of the East India Company, which was immediately resold for ready money, of course much under its cost.² It was even proposed to issue a base coinage, "to be such that three pence in silver, added to a quantity of copper, should be made to go current for twelve pence." This business had several days' debate, but was finally rejected, under the advice of Sir Thomas Rowe, who, from his great experience in the "coyns of Sweden and other forraign parts," was specially summoned to advise the Council upon the subject. Sir Thomas's speech to the Council, a valuable memorial of the state of economical science at the time, is given at full length in Rushworth.³

He averred that "enfeebling the coin was but a shift for a while, as drinke to one in a dropsy, to make him swell the more;" and he concluded with a reference to the balance of trade, a theory then in its infancy, which, wonderful to relate, even now retains its hold upon the imaginations of some persons. "If," said he, "the issue of native commodities may be brought to o'erbalance the entrance of the foreign, we need not seek any shift."⁴

The most unjustifiable of all the practices of this king, was his seizure, in the month of July, 1641, of the bullion deposited in the Mint to be coined, or, when coined, left there apparently for security. This was principally the property of foreign merchants; and, by earnest and energetic representations, the owners contrived to get two-thirds of it out of the royal grasp, but were compelled to leave the remaining third, amounting to £40,000, as a loan, in the hands of the king, who offered the security of the farmers of the Customs, which the merchants were obliged to

¹ Rushworth: *Hist. Collections* iv. 1181.

² *Ibid.* iv. 1216.

³ *Ibid.* iv. 1218.

⁴ There is a very extraordinary circumstance relating to this speech, which seems to leave the authorship of it doubtful. In the posthumous works of Sir Robert Cotton (*Cottoni Posthuma*; *Divers Choice Pieces* of that renowned Antiquary, Sir Robert Cotton, Knight and Baronet, preserved from the injury of time and exposed to public light for the benefit of posterity, by J. H., Esq.: London, 1651) a copy of the speech attributed by Rushworth to Sir Thomas Rowe is printed as having been delivered by Sir Robert Cotton before the Privy Council on the 2nd September, in the second year of King Charles (1626). There can be no doubt as to the identity of the two speeches, which, with two or three insignificant exceptions, are word for word the same. Cotton died in 1631; and it will be observed, the speech attributed to him was not published as his until twenty years afterwards, nor until eleven after it is said to have been spoken by Sir Thomas Rowe.

accept, for the repayment of the amount, with interest—at what rate is not stated.¹

This act of Charles I. is said to have led to a practice which was the foundation of the modern system of banking; as the merchants, from their distrust of the security of the Mint, began thenceforward to deposit their bullion and spare cash with the goldsmiths.

By these and other means, the king was able, in three weeks, to obtain £300,000 — “a sum,” says Clarendon, “that sufficiently manifests the plenty of that time, and greater than any prince in Europe could have commanded in so short a time;” but the historian, with astonishing effrontery, suppresses all mention of the king’s unlawful proceedings, and describes the money as having been obtained by voluntary loans “of the particular lords of the council and of other private gentlemen about the city,” adducing it, moreover, as “an unanswerable evidence that the hearts of his subjects were not yet aliened from their duty to the king, or a just jealousy of his honor.”²

To avoid a meeting with the hated and dreaded Commons, the king called at York a great council of Peers, to whom it was suggested “that they might give subsidies;”³ but they went no further than to join in a letter to the City of London, asking for a loan of £200,000, for which the Peers present were to become jointly securities with his Majesty.⁴

This letter, dated the 25th September, 1640, and signed by all the Peers present, was itself a severe reflection on the king’s previous measures, as it declared that his Majesty, to their great joy and comfort, had announced his intention to summon a Parliament for the 3rd of the following November.

With the Long Parliament, which met on that day, commenced an entire change in the financial system of the English Government, a change, however, not fully effected until the Revolution.

As the whole of our existing National Debt, with the exception of a small fraction of it, has been contracted since the latter event, it has generally been thought that the system of providing for the

¹ Rushworth iv. 1216.

² *Hist. Rebellion*, book ii. Hume, in noticing the errors and partiality of Clarendon, gives him full credit for honesty of intention (*Hist. Eng.*, chap. lxiii.); and, recently, an accomplished critic in the *Times* repudiated rather strenuously the charge of wilful falsification brought against the historian of the Great Rebellion in Mr. Forster’s admirable *Essay on the Grand Remonstrance*. It is impossible that Clarendon could have been ignorant of the nature of the transactions mentioned in the text, or that he could have been honest in describing them as he has done.

³ *Hist. Rebellion*, book ii.

⁴ Rushworth, part i., iv. 1281.

public service by loans was then first originated; and Smollett, in his *History of William III.*, reproaches that monarch with introducing the practice of borrowing upon remote funds.¹ With reference to this opinion, Lord Macaulay has truly remarked—"There can be no greater error than to imagine that the device of meeting the exigencies of the State by loans was imported into our island by William III. From a period of immemorial antiquity, it had been the practice of every English Government to contract debts. What the Revolution introduced was the practice of honestly paying them."²

Allusion has already been made to the heavy debts incurred by the first and third Edwards;³ nor were they rare instances, as every English monarch, from Henry III. to Charles II., with the exception of Henry VII. and Elizabeth, lived and died in debt.

Elizabeth certainly left liabilities to be discharged by her successor, but arrears of revenue sufficient to meet them were due at her death, besides claims of very large amount both from the King of France and the Republic of the United Provinces.⁴

Such public debts as are here alluded to, were, however, due from the Crown, and not from the nation. The supplies raised by taxation were not appropriated to any special services by the Parliaments that voted them, but were entrusted to the king for the general wants of the Government.

As these were often of too pressing a nature to wait for the slow collection of taxes, the king obtained advances upon the security of the grants. The monarchs occasionally expended these as well as the loans for which they were pledged; and, at any rate, it generally happened that before one debt was liquidated another was incurred.

In the reign of Richard II., London, and the other great commercial towns, being applied to for a loan, declined, on the ground of the great losses they had suffered by such transactions, to make any advances except upon the security of the Parliament; and, as this could not be obtained, the king was compelled to forego the expedition for which the funds were required.⁵ The embarrassments of Henry VI. reached such a pitch that the legislature was induced to offer its guarantee, in order that he might obtain a loan; and Hume notices this as the first instance in our history of money borrowed upon parliamentary security.⁶

¹ *Hist. England*, book i., chap. lxxi.

³ *Assurance Mag.* vi. 325-328.

⁵ *Ibid.* i. 385.

² *Hist. England* i. 289.

⁴ Sinclair's *Hist. Pub. Rev.*; 3rd edit., i. 220.

⁶ *Hist. England*, chap. xxi.

As the expenditure of the Government increased, the native capitalists were either too poor or too exorbitant for the monarch to have recourse to them, and loans were negotiated abroad, principally with the merchants of Antwerp, a city then at the head of European finance.

Elizabeth thus obtained, by the instrumentality of Sir Thomas Gresham, £200,000 for reforming the coin.¹

According to Stowe, the men of Antwerp charged interest at 10 or 12 per cent. for their advances, requiring, moreover, the guarantee of the city of London. He praises highly the patriotism and ability of Gresham, who obtained a loan for the queen from the Company of Merchant Adventurers, and thereupon relieved her from dependence upon foreigners.²

The Company of Merchant Adventurers was an association of wealthy merchants resident in London, or in important maritime towns, principally upon the eastern coast, who traded with the Netherlands;³ and it was probably the service thus rendered to Elizabeth that induced her to grant them (A.D. 1564) a charter of incorporation,⁴ the first they obtained, although they had been in existence for nearly three centuries before, and carried on so considerable a trade that the woollen cloth exported by them to the Netherlands in a single year was valued at a million sterling.⁵

The Long Parliament being resolutely bent on keeping such portion of the public revenue as they could control out of the hands of the king, who they had every reason to fear would make use of it for purposes injurious to freedom, were compelled to take upon themselves functions that, until that time, had been the exclusive province and prerogative of the monarch.

Shortly after their meeting, having voted that the sum of £100,000 should be raised by subsidies, they proceeded to obtain advances in anticipation of the grant. These advances were at first made upon the credit of certain aldermen and other citizens of London, who gave their personal security for the money, and were, by a vote of the House of Commons, passed on the 16th November, 1640, appointed to receive it and retain it in their hands for the public service.⁶

This was but a temporary expedient; the liabilities went on accumulating; and on the 28th May, 1641, there occurs, for the first time, in the Journals of the House, an expression destined to

¹ Hume : *Hist. England* ; Appendix, No. 3.

² *Survey of London*, book i., p. 286.

³ Macpherson : *Hist. Com.* ii. 15, 220.

⁴ *Ibid.* ii. 140.

⁵ *Ibid.* ii. 220.

⁶ *Commons' Journals* ii. 30.

be often repeated, and to become of momentous import in succeeding ages.

It was reported that the total *debt of the kingdom* amounted to £773,900.¹ Only a small part of this was money borrowed, as it consisted principally of arrears due to the Scottish army and the army of the king, both of which the Parliament had undertaken to pay.

At the same time, it was reported that the Company of Merchant Adventurers had offered to advance sums of either £150,000, £120,000, or £50,000, upon certain conditions, which the House accepted.²

The Company apparently wished to retrace their steps, for they were informed, in reply to a petition which they presented the following day, that the House expected the performance of their bargain.³ On the 17th June, the Merchant Adventurers were ordered to attend a committee of the House "as to the raising of moneys";⁴ but it appears that no satisfactory arrangement was made, as on the 14th July following the House passed a very significant vote, appointing a committee to take into consideration the several patents granted to the Merchant Adventurers, and to examine complaints.⁵

In the meantime, to alleviate the pressing wants of the Parliament, it was proposed to make Spanish money current, and to increase to 10 per cent. the interest upon money brought in,⁶ although a Bill for reducing the legal rate from 8 to 6 per cent. had been read a second time in the House of Commons only three months before.⁷

By whatever means induced, the Company, in the following month of December, agreed to lend £50,000 upon security offered by the House, at an interest of 8 per cent., and on the 28th they received the thanks of the House for it, as "a great service and of great concernment to the Commonwealth."⁸

The difficulty experienced in obtaining such a small amount will seem extraordinary, if the latter be compared with the sums said to have been raised by the Government in the period of nineteen years from the 3rd November, 1640, to the 5th November, 1659, according to an account published in Sinclair's *History of the Public Revenue*, third edition.⁹ The total there stated is upwards of £83,000,000, or an average of nearly £4,400,000 per annum; but the statement appears to be a very exaggerated one.

¹ *Commons' Journals* ii. 160.

² *Ibid.*

³ *Ibid.* ii. 161.

⁴ *Ibid.* ii. 170.

⁵ *Ibid.* ii. 210.

⁶ *Ibid.* ii. 178.

⁷ *Ibid.* ii. 108.

⁸ *Ibid.* ii. 358.

⁹ i. 285.

Whatever the distresses of his opponents, those of the king were much greater, and in February, 1643, he applied in vain for a loan of only £20,000 to the Merchant Adventurers, who communicated his letter to the House of Commons, and were, as they no doubt expected to be, enjoined not to make the advance.¹

After the loan, no more was heard of the committee upon the patents of the Company; and on the 28th May, 1642, a Bill for incorporating the Merchant Adventurers of England trading to Germany, Calais, and the Seventeen Provinces of the Netherlands, was read a second time in the Lower House.²

There are many orders of the House, in the course of the civil war, for the payment of various sums of money, with interest—the rate of the latter, when named, being always the legal one of 8 per cent.

During the existence of the contest, the demand for money was an insuperable obstacle to any reduction in the rate of interest; but a proposal to that effect was made on the 12th March, 1649.³

The measure was not carried until more than two years afterwards; when it was enacted, on the 8th August, 1651, by the sole authority of the House of Commons,—the House of Peers having been abolished,—that from the 29th September following no higher rate than 6 per cent. should be charged for interest.⁴

In the course of the discussion on this Bill, many suggestions were made for the reformation of the law, some of which, so slow is the progress of human improvement, have not yet, while others have only recently, been adopted.

It was recommended to the committee on the measure, to bring in a Bill for making “lands, as well freehold as copyhold, liable to pay debts, and to enforce such as are able to pay their just debts.”⁵

A measure for the general registration of conveyances, which had been previously originated, was recommended at the same time, and continued to be frequently discussed for many succeeding sessions.⁶ At length, in 1656, its advocates pressed it so strongly upon the House, that, after many debates and adjournments, it was only got rid of by the appointment of a committee to report to the House as to incumbances.⁷

It was, no doubt, in reference to the proceedings of this committee, that the parliamentary general, Edmund Ludlow, declared, in his indignation at the obstacles to legal reform raised by the

¹ *Commons' Journals* ii. 981, 982.

² *Ibid.* ii. 591.

³ *Ibid.* vii. 162.

⁴ *Ibid.* vii. 618.

⁵ *Ibid.* vii. 575.

⁶ See *Journals* vi., pp. 360, 388, 488, 491, 500, 503, 576; vii., pp. 213, 246, 249, 250, 251, 253, 427, 435, 437–439, 441, 449, 450, 659.

⁷ *Ibid.* vii. 441.

members of the legal profession, "that the word 'incumbrance' was so managed by the lawyers that it took up three months' time to ascertain its meaning."¹

Nothing further was heard on the subject, beyond a faint attempt to revive it made on the 19th May, 1659;² and on the approaching termination of two centuries from that date, we shall probably be very far from the adoption of any general measure of the kind, although its practical utility has been demonstrated in local cases.

In 1704, it was enacted, by the 2nd and 3rd Anne, cap. 4, that memorials of all deeds, conveyances, and wills, relating to lands in the West Riding of Yorkshire, should be registered in an office to be appointed for the purpose; and that after such register, every subsequent deed, &c., relating to such lands, should be considered fraudulent and void, unless a similar memorial thereof should be registered in like manner.³

In 1708, a similar regulation for the East Riding was enacted by the 6th Anne, cap. 25,⁴ and extended to the county of Middlesex by the 7th Anne, cap. 20, in 1709,⁵ as it was likewise to the North Riding of Yorkshire in 1735, by the 8th George II. cap. 6.⁶

It may readily be supposed, that the confusion which existed after the death of Cromwell was not favourable to the regular collection of revenue; and it is not therefore surprising, that the Parliament which completed the Restoration should have found the Exchequer entirely bare. The House of Commons having, on the 5th May, 1660, voted £500 for the purchase of a jewel to Sir John Grenville, the bearer of the king's letter to the two Houses, was without the means of paying the money until it was advanced by a private member, Mr. Forth, who received the thanks of the House for the same.⁷

Immediately after passing a resolution of thanks to the king for his gracious offers, it was ordered that a sum of £50,000 be presented to his majesty, and £10,000 each to the Dukes of York and Gloucester, and that a Committee be appointed to arrange with the corporation of London for the raising that sum, as well as a further one for paying the army, the whole to bear interest at 6 per cent.⁸

The credit of the new Government does not appear to have been high; as, on the 25th May, Alderman Frederick reported to the

¹ *Ludlow's Mem. Vevay*, 1698, i. 438.

³ *Hist. Com.* ii. 730.

⁴ *Ibid.* iii. 4.

² *Commons' Journals* vii. 659.

⁵ *Ibid.* iii. 9.

⁶ *Ibid.* iii. 205.

⁷ *Commons' Journals* viii. 14.

⁸ *Ibid.* viii. 4.

House that the members appointed to raise £2,000 in the city for his majesty's present service, finding a difficulty therein, had advanced the money themselves.¹

The reduction of the legal rate to 6 per cent. under the Commonwealth, was held at the Restoration to be void, as the act of a usurped authority; and attempts were made to revive the rate of 8 per cent. allowed by the 21st James I., considered to be still in force. An Act was therefore passed, reciting such attempts, and that the abatement of interest had been found, by notable experience, beneficial to the advancement of trade and improvement of lands by good husbandry, likewise that in fresh memory the like fall to six in the hundred, by a *late constant practice*, had found the like success, to the general contentment of this nation.

This Act, 12th Charles II, cap. 13, which received the royal assent on the 27th August, 1660, confirmed the reduction of interest to 6 per cent., and subjected any person taking a higher rate to penalties precisely similar to those of the 21st James I. In the following year, a Bill was introduced into the House of Commons for discharging those whose estates had been sold, sequestered, or decimated, for adhering to his majesty or his royal father, of all interest exceeding 3 per cent. per annum. This iniquitous attempt to compensate, at the expense of their creditors, men who, if entitled to compensation at all, ought to have received it from the public at large, was actually passed by the House of Commons,² but defeated by the Lords, who rejected the Bill when sent up to them.³

For considerably more than a century, the belief in the stability and integrity of the British Government has been so strong, that, except upon a few extraordinary occasions of great political disaster, or of unusual demand for loans caused by excessive expenditure, the interest yielded by investments in the public funds has invariably been looked upon as regulating the rate to be obtained upon securities of the first class. Under the Stuarts, and for some years after the Revolution, the case was widely different.

Charles II. was never able to borrow at the legal rate of 6, but paid ordinarily 8, and sometimes 10, per cent.; while, according to Sir Josiah Child, the holders of Exchequer tallies, the only transferable Government securities then existing, except seamen's tickets, were often compelled to discount them at 10 or 12 per cent.⁴ So rapidly and effectually did the king's profusion

¹ *Commons' Journals* viii. 45.

² *Ibid.* viii. 311.

³ *Lords' Journals* xi. 323.

⁴ *Discourse on Trade*; Lond., 1693, p. 20.

and irregularities lower his credit, that within two years of the Restoration, on the 13th February, 1662, he caused a Bill to be introduced into the House of Commons to make it lawful for persons who might lend him money to receive interest at 10 per cent.

The Bill was vehemently discussed for two days in a committee of the whole House, and on the 17th February was adjourned, "after much debate;" but on the 18th, Mr. Secretary Morrice informed the House he had directions from his majesty to desire they would put a supersedeas to any further debate on the Bill, as his majesty, "finding it might have some ungrateful relish in it, resolved to put himself on the greatest streights rather than adventure upon any course that might disgust the House, or prejudice his good subjects." The Commons returned thanks for the message, and promised to leave no means unattempted to advance his majesty's revenue.¹

On the 22nd February, 1664, a similar measure for permitting persons lending money for his majesty's occasions to take more than 6 per cent. interest, was rejected in the House of Commons by a majority of 82 to 67.²

Of the many unprincipled acts of this monarch in pecuniary matters, the most unprincipled was the celebrated closing of the Exchequer on the 12th January, 1672.

I have already mentioned, that the seizure, by Charles I., of the bullion in the Mint, led to the custom of depositing money with goldsmiths, the foundation of the modern system of banking.³

The goldsmiths of London were renowned for wealth at the commencement of the seventeenth century; and writers of the time celebrated the splendid display of gold and silver plate exhibited on the south side of Cheapside, which, from Bucklersbury to Old Change, was called Goldsmith's Row—all the shops therein, with the exception of four only, being occupied by goldsmiths. Their business, up to the period in question, consisted principally in the purchase and sale of plate and bullion; but they derived considerable profit from exchanging foreign monies, notwithstanding the Acts of Parliament restricting such transactions to the royal exchangers—Acts which Charles I. appears to have attempted in vain to enforce. They had, moreover, another and even less legitimate source of gain. So imperfect was then the state of the arts, that to coin numerous pieces, each of precisely the same weight of metal, appears to have been beyond the skill of the time,

¹ *Commons' Journals* viii., pp. 362, 364, 366, 367.

² *Ibid.* viii. 604.

³ *Ante*, p. 80.

and we are told that many of the half-crowns struck by the Parliament, during the Great Rebellion, differed from each other by as much as twopence or threepence in the value of the silver they contained. The goldsmiths made large profits by picking out the heavier coins and melting them down for sale; and they appear to have taken a similar advantage of the imperfect manner in which the relative values of the silver and gold coinage were regulated.¹ It was probably their familiarity with monetary operations, as well as their large capital and consequent high credit, that led to the practice of depositing cash with them—a practice that in the reign of Charles II. had greatly extended with the increase of trade, and had become so general as to attract the attention of most of the contemporary writers upon commerce and finance. Locke notices it, as almost beyond belief, though true, “that one private goldsmith in London should have credit upon his single security (being usually nothing but a note under one of his servant’s hands) for above eleven hundred thousand pounds at one time.”² Sir Josiah Child attributed “to that innovated practice of bankers in London,”³ or, as he elsewhere contemptuously styles it, “this new invention of cashering,” the low price of land, the high rate of interest, and the stoppage of the increase of our trade; but he bore unconscious testimony to its utility when he pointed out that “before this way of private banking came up, men who had money were forced oftentimes to let it lie dead by them until they could meet with securities to their minds,” which, he estimated, “would (*communibus annis*) in effect take off 1 per cent. per annum from the profit of usury.”⁴ The trade of banking was evidently rendered necessary by the number and extent of commercial transactions, and was merely an extension of the principle of the division of labour which interposed between lenders and borrowers a class of agents similar to those who from time immemorial had acted between producers and consumers.

As has been the fate of most useful innovations, it was objected to by many merely because it was new—people complaining that it was a strange sort of thing to see the paying and receiving of money going on from morning till night in an open shop.⁵

In addition to holding the current balances of their customers, and managing all their receipts and payments, the goldsmiths adopted a practice which has recently been revived in London

¹ *Hist. Com.* ii. 427.

² *Works*; Lond., 1812, v. 8.

³ *Trade, &c., considered*, p. 17.

⁴ *Ibid.*, p. 18.

⁵ *Hist. Com.* ii. 562.

banking, and, as we have seen, was of very ancient date—that of taking money upon deposit and allowing interest thereon.

The receipts given for such sums were called “goldsmiths’ notes,” and the frequent mention of them in documents of the period shows how general the use of them must have been.

As the only mode of realizing a profit upon such transactions must have been to obtain a higher rate of interest than was paid, we are surprised to find it stated by Bishop Burnet that the goldsmiths allowed upon deposits the then full legal rate of 6 per cent.¹

We are told, however, by Sir Josiah Child, in the supplement to his *Discourse concerning Trade*, that his majesty having been enforced to give above the usual rates to goldsmiths, the latter were encouraged to take up great sums from private persons at the full rate of 6 per cent., whereas they formerly usually gave but 4 per cent.; and the same writer further says, in a tract entitled *Trade and the Interest of Money considered*, written in 1669, but published later, that before the late emergencies, the goldsmiths of London could have “what money they would, upon their servants’ notes only, at £4 or £4. 10s. per cent.”² Macpherson asserts, without giving any authority for the statement, that the ordinary rate allowed by the goldsmiths before this time was 4 per cent.³ Out of the money thus obtained, large sums were lent to the king at 8 per cent.—the lenders receiving apparently something additional in the way of commission upon the repayments, which being made weekly at the Exchequer as the taxes came in, enabled them to fulfil their engagements to their customers.⁴

That this state of things must have had the effect of raising the rate of interest to ordinary borrowers cannot be doubted, for the goldsmiths would hardly take in money at 6 per cent. to lend it at the same rate. As, however, transactions at any higher rate were illegal, some modes of evading the law must have been adopted; but evidence of these was not likely to be made public. Lord Macaulay, speaking of the sum of £60,000 left by George Monk, Duke of Albemarle, who died about this time (A.D. 1670), says, it “probably yielded seven per cent.,”⁵ which was one per cent. above the rate allowed by law; and Locke evidently referred to the same period, when—in illustration of his argument, that to reduce the legal below the market rate of interest would only increase the profits of bankers and brokers, without any benefit to borrowers—he said: “Some years since, the scarcity of money having made it

¹ *Hist. of his own Times*; Smith, London, 1693; p. 36.

³ *Hist. Com.* ii. 519.

⁴ *Ibid.* ii. 561.

² p. 32.

⁵ *Hist. Eng.* i. 308.

in England really worth more than 6 per cent., most of those that had not the skill to let it for more than 6 per cent. and secure themselves from the penalty of the law, put it into the banker's hands."¹ The profits of the goldsmiths were destined, however, to meet with a sudden and violent termination.

The pride of the English princes of the House of Stuart was of a peculiar kind. Some of the wisest monarchs mentioned in history have made it their glory to pay to the laws of the countries they governed the same scrupulous deference they exacted from their meanest subjects; but the unfortunate race in question were actuated by different feelings. Submission to law and the restraints of parliamentary government they looked upon as a degradation, and it was the only degradation from which they shrunk. To avoid it, they were ready to descend to any meanness, however low—to commit any breach of faith, however atrocious.

In the beginning of 1672, Charles had recently concluded the shameful treaty by which he became a pensioner of the French king; and, although he had obtained from the Parliament just prorogued a considerable grant, he was entirely unprovided with money to meet the expenses of the war with the United Provinces, which was one of the results of his French connexion. It is asserted, that having in despair offered the position of Lord Treasurer to any one who would point out the means of obtaining a supply, Sir Thomas Clifford secured the office by suggesting the plan of closing the Exchequer, and intercepting the funds appropriated to the repayment of the goldsmiths' loans. Some doubt, indeed, has been thrown over this part of the story. Burnet not only asserts that the Earl of Shaftesbury "was the chief man in the advice," but adds, "he excused himself to me, telling me what advantage the bankers had made, and how just it was of the king to bring them to account for their usury and extortions."² There appears to be no doubt that Lord Shaftesbury, in anticipation of the blow, drew out all the money he had lying in the hands of the goldsmiths, and advised his friends to do the same.³ The sum due from the king was £1,328,526, and the unfortunate bankers received notice, on the 12th January, 1672, that the principal could not be discharged, but that interest upon it at the rate of 6 per cent. would be allowed. Many of them, thus rendered unable to meet their engagements, were compelled to stop payment, involving in their ruin a vast number of merchants and traders. The city was thrown into violent commotion, and the shock spread alarm throughout the

¹ *Works* v. 9.

² *Hist. of his own Times*, p. 204.

³ *Ibid.*

country, a proof of the intimate connexion that had arisen between the trading communities of the kingdom.¹ This was, indeed, the first instance in English history of a commercial panic; for although, in the year 1667, when the Dutch fleet was riding unopposed in the Medway, and the sound of foreign cannon was heard for the first and only time by the citizens of London, a run upon the goldsmiths had commenced, caused by the fear that the king would fail in his payments to them, it was stopped by a proclamation announcing his resolution to adhere inviolably to his engagements.²

The interest promised by Charles was not regularly paid; and after the Revolution, his victims sought the aid of the civil courts in enforcing their claims upon the royal treasury. Many years of litigation followed; but at length a decision was given (A.D. 1697) in their favour and against the Crown. The legislature then stepped in, and passed an Act charging the hereditary revenues of the sovereign with the payment of interest at 3 per cent. upon the original debt, but making it redeemable for one-half, or £664,263—being equivalent to a payment of ten shillings in the pound.³ That sum was incorporated by the 3rd George I., cap. 7 (A.D. 1717), into the general fund at 5 per cent., subsequently reduced to 3 per cent., at which rate we now pay annually £19,927. 18s. 6d. upon this the most ancient of the numerous and enormous liabilities forming our national debt.⁴

It might be thought that, after such a flagrant breach of faith, the king would never again have found anyone credulous enough to trust him; nevertheless, Hume mentions it as a surprising fact, and a proof that public credit is not of so delicate a nature as is generally supposed, that, within two years of his closing the Exchequer, Charles was able to borrow at the same rate of interest he had paid before that event.⁵

One of the persons with whom he had large dealings in the latter part of his reign was Charles Duncombe, who rose to great eminence as a goldsmith, and in that business laid the foundation of a princely fortune and of a house ultimately ennobled; but who evidently hesitated at no means, however vile, of acquiring wealth, as he was, in 1697, expelled the House of Commons for conspiring to defraud the Government by forged endorsements upon Exchequer Bills.⁶

In 1697, an account was made out by order of the House of

¹ See Hume, Macaulay, Burnet, &c.

³ Sinclair: *Hist. Pub. Rev.* i. 401.

⁵ *Hist. Eng.*, chap. lxxi.

² *Hist Com.* ii. 530.

⁴ *Ibid.*

⁶ *Commons' Journals* xii. 78.

Commons, of the sums paid for interest to Richard Kent and Charles Duncombe, Esquires, joint cashiers of the Customs and Excise—an office which Duncombe had probably accepted in order more effectually to secure the repayment of his advances, and, perhaps, by its emoluments to increase the interest he obtained upon them. From this account, which runs from 1676 to 1686, the sums actually charged for interest appear to have been always at the legal rate of 6 per cent.; but gratuities, or remuneration for services, were, in all cases, paid in addition, sometimes at the rate of 2, and sometimes at the rate of 4, per cent. per annum. Upon the accession of the frugal James II., the rate of interest dropped at once to 5 per cent.¹

There are few additional facts to be noticed in relation to the subject until the period of the Revolution. During the reigns of Charles II. and his successor, the policy of reducing the legal rate of interest was strongly urged in many publications, but only one attempt to effect the object was made in Parliament. On the 12th April, 1668, leave was given in the House of Commons, by a majority of 116 to 73, to bring in a Bill for reducing the rate of interest for money. The Bill was debated on the 22nd of the same month, when the discussion was adjourned, and it was not resumed during the session.²

The great accumulation of capital that had taken place during the period we have considered, necessarily had the effect of increasing the saleable value of land, as compared with the income derived from it; but there is some discrepancy in the evidence upon the subject. The House of Commons, during the Long Parliament, on the 28th April, 1649, ordered that the price to be put upon dean and chapters' lands should not be under fifteen years' purchase for lands in possession, and for reversions after the same proportion.³

According to Davenant, the value of land in 1666 was in the best counties from eighteen to twenty years' purchase, and in the worst from fourteen to sixteen.⁴ Sir Josiah Child admits, that at the same period (1665), the average was below twenty years' purchase.⁵ Locke, referring to a time somewhat later (1680), speaks of eighteen to twenty years' purchase as the ordinary rate; but adds, that near places wherein thriving manufactures had been established—such as Halifax in the north, Taunton and Exeter in the west—two or three and twenty years' purchase were com-

¹ *Commons' Journals* xii. 114.

³ *Ibid.* vi. 197.

⁴ *Works* i. 359.

² *Ibid.* ix. 79, 86.

⁵ *Trade, &c. considered*, p. 15.

monly obtained.¹ Sir Josiah Child asserts, that land in Italy sold for from thirty-five to forty years' purchase,² and he quotes eighteen years' purchase as the price in France;³ although, according to another writer, apparently well-informed, lands in that country termed noble, or giving titles of honour, sold as high as thirty-four to thirty-five, while the vulgar or ordinary lands sold for twenty-five, years' purchase.⁴ The last-mentioned author states, that land in Holland sold for from thirty-five to forty years' purchase; but this he attributes to the smallness of the country and the miraculous numbers of men, there being, as he gravely affirms, *scarce six feet square of land to every inhabitant*⁵—an estimate that would give between four and five millions of people to the square mile, and to the whole country above five times as many as the entire globe is supposed to contain. It may seem incredible that such an extravagant idea could have been entertained by anyone, especially by a person whose writings show that he possessed much general knowledge as well as an extensive personal acquaintance with foreign countries; but before the application of statistical science to the subject, the wildest notions were current with respect to population. In the reign of Charles II. (1661–2), Sir William Petty published his *Observations upon the Bills of Mortality*, in which he says he was led to the endeavour to determine the numbers of the people by an assertion, made in his presence, that London, in the year 1661, contained two millions more inhabitants than before the Great Plague in 1625.⁶

The appearance of this work was the first step in the modern science of vital statistics, preceding, as it did, by about ten years, the treatise upon annuities of the celebrated De Witt, recently brought to light by Mr. Hendriks.⁷ The attention it excited may be inferred from the fact that it went through five editions in fifteen years. It was published in the name of Captain John Graunt, a Fellow of the Royal Society; but the real authorship was casually disclosed by Bishop Burnet, in a notice of Graunt, who, being a Roman Catholic and a Director of the New River Company, was accused of having, in the latter capacity, intercepted the supply of water during the Great Fire.⁸ Graunt was, probably, as innocent of this charge as he was of writing the observations that were published in his name, which may thus

¹ *Works* v. 39.² *Discourse of Trade, &c.*, p. 14.³ *Ibid.*⁴ Manley: *Usury at Six per Cent. examined*, p. 32.⁵ *Ibid.*⁶ *Natural and Political Observations on the Bills of Mortality*; 5th edit.; London, 1676, p. 30.⁷ *Assurance Mag.* vi.⁸ Burnet: *Hist. of his own Times*, p. 204.

singularly become connected with the history both of fire and life insurance without his having deserved it in either case.

In the year 1685, the illustrious Newton appeared in the character of an actuary, and published a series of tables for renewing or purchasing church and college leases. The rates of interest upon which these tables are founded vary from 5 to 12 per cent.; but the author appears to have considered 6 the most likely one to be employed, as the examples are principally given at that rate.

The Scottish Parliament (Parl. I., Car. II., cap. 47), in the year 1661, reduced the legal rate of interest to 6 per cent.; nevertheless, Sir Josiah Child speaks of 10 and 12 per cent. as commonly paid, about the same time, in Scotland and Ireland for interest.¹ The rate in France he cites as 7 per cent.;² in Turkey, 20 per cent.;² in Spain, 10 or 12 per cent.;² "and there," he continues, "notwithstanding they have the only trade in the world for gold and silver, money is nowhere more scarce."² In Holland and Italy, he says, the rate was 3 per cent.; and in this he is confirmed by Manley, who wished his readers to notice that all Europe exceeded us "in the rates of usury—Holland and some commonwealths of Italy only excepted."³

The rapid fall of the rate of interest in Holland was the constant theme of writers upon commerce in the 17th century; and not having been enforced by any legislative enactment, but resulting entirely from the rapid accumulation of wealth in the country, it was, until the present time, the most striking evidence that could be adduced of the material advantages that flow from the combination of political and commercial freedom.

The rate of interest in the Low Countries, before the struggle with Spain (1566), was upwards of 12 per cent. In the beginning of the 17th century, it fell to 6 per cent. in Holland. Notwithstanding the sacrifices required by the War of Independence, and long before the termination of that war in 1648, the public debt of the United Provinces bore no higher interest than 5 per cent. Shortly after that event, the Government, in 1655, was enabled to reduce the rate paid upon it to 4 per cent., although it amounted to the large sum of fourteen millions sterling.⁴

It was intended that the saving effected by the reduction should be employed in redeeming the principal, which was expected to be thus extinguished in twenty-one years. This was a suggestion

¹ *Discourse concerning Trade*, p. 14.

² *Trade, &c., considered*, p. 6.

³ Preface to *Usury at Six per Cent. examined*.

⁴ *Hist. Com.* ii. 463.

of De Witt's, and is the first example of the establishment of a sinking-fund.¹

Perhaps it may excite surprise, that the Government of the Pope was the only one in Europe then enjoying a degree of credit equal to that of the Dutch. In 1685, the debts of the Pontifical Government amounted to about eleven millions sterling; and the Pope, Innocent XI., finding they were selling at 122 per cent., although bearing interest at only 4 per cent., offered the holders the alternative of taking back their capital or of lowering the interest upon it to 3 per cent. The reduction was not only assented to, but the 3 per cent. stock shortly afterwards rose to 112 in the market.²

(END OF PART III.)

*The Principles which should regulate the Reassurance
of Risks.*

THE extent to which the interchange of risks is made by Assurance Companies at the present day, renders it of no small importance that a clear understanding should exist as to the terms upon which these contracts are to be carried out. There was a time, we believe, when a proposition from one Company to effect an assurance with another was looked upon with coldness, if not with suspicion; and the fact that such proposals were often made when the proposing Office declined to assume any portion of the risk itself, would seem, very naturally, to give rise to such a sentiment. This practice, however, we believe, is now quite on the decline; and with well-conducted Companies it is pretty clearly understood that these transactions must be in every respect perfectly *bonâ fide*, and that the arrangement of them must be entirely just and equal, as between all the parties concerned. As the wealth of the country increases, the cases are becoming more frequent in which the sums to be assured upon individual lives are larger than any single Company would care to sustain the liability of; and as propositions of this nature are being at intervals made to all, each becomes sensible of the advantages of the system of reinsurance, and of the necessity of its being based upon principles of perfect fairness and equality. It was, no doubt, under these impressions that the managers and actuaries of several Offices were induced, some years back, to draw up the following "Regulations." The object in view will be ap-

¹ *Hist. Com.* ii. 463.

² *Ibid.* ii. 622.

parent on a perusal of them; and although they have not hitherto been formally adopted, it is hard to believe that the adoption of them, with certain modifications, would not be attended with advantage.

The "Regulations," as originally framed, are as follows:—

REGULATIONS TO BE OBSERVED IN CASES OF REASSURANCE.

As it frequently becomes necessary for Life Assurance Offices to re-assure with each other certain portions of the assurances effected with them; and as it is inexpedient that such reassurances should be subject to the conditions insisted upon in ordinary cases, it is suggested that the following regulations be observed in all such transactions:—

1. The Office receiving a proposal, and wishing to reassure, shall communicate to the Offices with which its reassurances are intended to be effected, every particular which shall come to its knowledge in relation to the proposal in question, or to any former proposals it may have received upon the same life, and shall give the necessary facilities for enabling such Offices to furnish themselves with certified copies of every document in its possession connected with such proposals.

2. When an acceptance of the proposal, in writing, signed by the actuary, secretary, or other principal officer, shall have been issued, the liability of the Office issuing such acceptance shall be held to have attached immediately on completion of the assurance with the principal Office, provided there shall be no undue delay in the payment of the reassurance premium.

3. Subject to the like proviso, the payment of renewal premiums to the principal Office shall be held as payment to the Offices reassured with.

4. The reassurances may be effected by the endorsement of a "guaranty" (duly stamped if required) on a copy of the policy issued by the principal Office.

5. The form of such guaranty to be as follows:—

"The directors of the A Assurance Company having granted an assurance on the life of....., the terms and conditions of which are within set forth, and the directors of the B Company having accepted a proposal for a reassurance to the extent of.....pounds in respect thereof, upon the like terms and conditions, subject to the exceptions and provisos hereinafter mentioned; now, we.....

.....being three of the directors of the said B Assurance Company, in consideration of the annual premium of..... payable when and as the within-mentioned premium is payable (the first payment of which said annual premium of £.....is hereby acknowledged to have been received), do agree to relieve the directors of the said A Company of their risk under the assurance within recited to the extent of £..... and fully to indemnify them to such extent against all contingencies to which they may be liable thereunder.

"Provided always, that the said B Company shall be entitled to receive its due proportion of any extra premium which may become payable, and be paid to the said A Company in respect of the said within-recited assurance.

"Provided also, that the said A Company shall have no claim to any bonus or addition to the sum hereby guaranteed other than that, if any, to be allotted in accordance with the rules of the said B Company.

"In witness whereof, we, the three directors above-mentioned, have hereunto set our hands, this.....day of....."

6. The principal Office shall not reassure or maintain with any one other Office a larger amount than it keeps at its own risk, unless by mutual consent.

7. When an extra premium shall become chargeable, the principal Office shall, after consultation with the other Offices interested, fix its amount, and the terms and conditions of the licence to be granted.

8. The principal Office shall not be entitled to demand consideration for the surrender of reassurances, unless it shall have paid a consideration for the cancelment of its own risk, nor shall it in any case, unless an agreement has been made to the contrary, have the right to prescribe the amount to be allowed in this behalf by the Offices reassured with.

9. The evidence produced in support of a claim on the principal Office shall, when admitted by such Office, be deemed sufficient by the Offices reassured with, and the sums guaranteed by the latter severally, shall become payable when and as the sum assured with the principal Office shall become payable.

10. Any question arising under a case of guaranty shall be referred to three principal officers of Life Assurance Companies; one to be selected by each Office interested, and the third by the two thus selected; and the decision of the majority of the three shall in all cases be final.

FORM OF PROPOSAL FOR REASSURANCE.

Proposal for Reassurance

Made by
To.....

Name and designation of Party whose life is to be Assured.	
Age next Birth-day.	
Sum to be Assured.	
Term of Assurance, and whether with Participation of Profits or not.	
Mode in which the Reassurance is to be effected.	

For all particulars in regard to the age, health, habits, &c., of the party above mentioned, reference is made to the documents herewith produced; and it is understood that the Office accepting the risk shall do so in terms of the printed "Regulations to be observed in cases of Reassurance."

Signed at, the.....day of.....18.....

(Signature).....Actuary or Secretary.

For the reasons referred to in our observations at p. 27 of this volume, the main object sought in effecting reassurances by endorsement on the original policy is now no longer needed, and it would seem to be preferable, in many points of view, to discontinue the practice, and in all cases to accept the policy usually issued by the Company. The conditions of policies, it is true, are often very different. But these differences it is obviously the precise object of the "Regulations" to ride over and to annul. We would therefore suggest that articles 4 and 5 be omitted.

In article 7 it may be well to insert the words "appear to" in the first line, and the words "with their concurrence, whether any shall be charged, &c." in the third line.

The provisions of article 8 are unsatisfactory, as being likely to lead to some injustice or disagreement. The most simple remedy would seem to be, to prescribe that a certain proportion of the premiums paid, say 35 per cent., shall always be allowed for surrender of these assurances. There does not seem any sufficient reason for the arrangements of the principal Office, on this head, being brought into consideration.

Thus amended, the "Regulations" would, probably, provide satisfactorily for all ordinary cases—the question of bonus excepted—and this, it will easily be seen, presents some difficulty. On the whole, it would appear to be the wisest course to arrange that all reassurances should be made on the non-participating scale—the object being, not to obtain any particular gain or advantage, but simply to reduce the amount of risk; and if this could be adopted, it would only be consistent that a table of rates should also be selected, in accordance with which all reassurances should be effected. As supplying such a desideratum, we venture to append a table suitable for the purpose, the rates being sufficiently high, and yet moderate, at all ages. If the principal Office desire to reassure with participation, a special contract on that point might be entered into.

With these modifications, the "Regulations" will assume the following form; and it seems to us that they would operate fairly and advantageously. The managers of Companies so estimating them would have no difficulty in giving in their adherence and signing the "understanding"; and if many did so, those who would not, must of course, be content to forego, to a great extent, a description of business which promises to be not only considerable in amount but rather more than ordinarily lucrative.

—ED. A. M.

REGULATIONS TO BE OBSERVED IN CASES OF REASSURANCE.

1. The Office receiving a proposal, and wishing to reassure, shall communicate to the Offices with which its reassurances are intended to be effected, every particular which shall come to its knowledge in relation to the proposal in question, or to any former proposals it may have received upon the same life, and shall give the necessary facilities for enabling such Offices to furnish themselves with certified copies of every document in its possession connected with such proposals.

2. The form of proposal shall be as follows:—

Proposal for Reassurance

Made by the.....Company

To the.....Company.

Name and designation of Party whose life is to be Assured.	
Age next Birth-day.	
Sum to be Assured.	
Term of Assurance, and whether with Participation of Profits or not.	

For all particulars in regard to the age, health, habits, &c., of the party above mentioned, reference is made to the documents herewith produced; and it is understood that the Office accepting the risk shall do so in terms of the printed "Regulations to be observed in cases of Reassurance."

Signed at....., the.....day of.....18.....

(Signature).....Actuary or Secretary.

3. When an acceptance of the proposal, in writing, signed by the actuary, secretary, or other principal officer, shall have been issued, the liability of the Office issuing such acceptance shall be held to have attached immediately on completion of the assurance with the principal Office, provided there shall be no undue delay in the payment of the reassurance premium.

4. Subject to the like proviso, the payment of renewal premiums to the principal Office shall be held as payment to the Offices reassured with.

5. The principal Office shall not reassure or maintain with any one other Office a larger amount than it keeps at its own risk, or pay a lower rate of premium than it receives itself, unless by mutual consent.

6. When an extra premium shall appear to become chargeable, the principal Office shall, after consultation with the other Offices interested, determine whether any shall be charged; and if so, what the rate shall be, and what the terms and conditions of the licence to be granted.

7. The principal Office shall be entitled, at any time, to demand consideration for the surrender of reassurances—such consideration to be at the rate of 35 per cent. upon the premiums paid.

8. The evidence produced in support of a claim on the principal Office

shall, when admitted by such Office, be deemed sufficient by the Offices reassured with; and the sums guaranteed by the latter severally, shall become payable when and as the sum assured with the principal Office shall become payable.

9. Any question arising under a case of guaranty shall be referred to three principal officers of Life Assurance Companies; one to be selected by each Office interested, and the third by the two thus selected; and the decision of the majority of the three shall in all cases be final.

Annual Premiums per Cent. for Reassurance of Risks without Participation.

Age next Birthday.	Rate per Cent.	Age next Birthday.	Rate per Cent.	Age next Birthday.	Payments.
£. s. d.		£. s. d.		£. s. d.	
15	1 12 1	33	2 8 1	50	4 5 1
16	1 12 8	34	2 9 5	51	4 8 7
17	1 13 3	35	2 10 11	52	4 12 3
18	1 13 11	36	2 12 4	53	4 16 1
19	1 14 7	37	2 13 11	54	5 0 3
20	1 15 4	38	2 15 7	55	5 4 8
21	1 16 1	39	2 17 4	56	5 9 4
22	1 16 10	40	2 19 2	57	5 14 4
23	1 17 8	41	3 1 1	58	5 19 7
24	1 18 6	42	3 3 2	59	6 5 2
25	1 19 4	43	3 5 5	60	6 11 1
26	2 0 3	44	3 7 9	61	6 17 6
27	2 1 3	45	3 10 3	62	7 4 3
28	2 2 3	46	3 12 11	63	7 11 6
29	2 3 4	47	3 15 8	64	7 19 2
30	2 4 5	48	3 18 7	65	8 7 4
31	2 5 7	49	4 1 9	66	8 16 1
32	2 6 10				

The Proposed Legislation for the Regulation of Insurance Companies.

THE remarkable change which has taken place within the last two or three years in the position and circumstances of these institutions has very much tended to allay the desire, so generally expressed formerly, for legislative interference, with a view to their better regulation. The impression, by which so many well-informed persons seemed to be actuated, that they might be multiplied with advantage almost indefinitely, appears now to have become thoroughly eradicated; and in its place a conviction seems to have arisen that the country cannot support a very large number of these Companies, and that the sooner the existing ones even are reduced in number the better. Be this as it may, we cannot but regard the rational and moderate ideas now prevailing on this subject as a vast improvement on the extravagant

notions heretofore generally entertained with regard to it; and, if reliance could be placed on the continuance of this better disposition, we think our readers will agree that the necessity for legislative interference has, in a great measure, passed away, and that the Assurance Companies might now be left to pursue their course guided by their own discretion and untrammelled by further restrictions. It is, however, more than probable that all will not coincide in this opinion, and that attempts will again be made to carry some measure for regulating these important institutions; and we have therefore thought it desirable to call attention to the fact that a Bill introduced by Mr. James Wilson and others, at the close of the Session of 1857, was well considered by the representatives of a great many Companies, was frequently amended at their suggestion, and was, at last, although deferred on account of the lateness of the Session, very generally approved, both by the Government and the Offices. It is the more necessary to bear this in mind, inasmuch as another Bill for the purpose in question was introduced, towards the end of the last Session of Parliament, by Mr. Brinsley Sheridan and Colonel French; which Bill, although characterized by much ability, could scarcely be looked upon as an improvement of its predecessor, and which, like it, was for a similar reason deferred. It is scarcely practicable, and it would hardly be desirable, to give in this place a copy of the whole Bill as introduced by Mr. Wilson; but it will, we think, be useful to reprint the clauses of it, and to give verbatim the regulations of Part VI., which are “applicable to all Life Insurance Companies,” and which, although much canvassed and amended at the time the Bill was in progress, may still be considered by some as susceptible of improvement. So many, however, of those most concerned were satisfied with the Bill as a whole, that it would probably pass, if again brought forward, with but little opposition, and it would at least serve, if not productive of much advantage, to prevent the adoption of a measure of a more objectionable character.—ED. A. M.

ARRANGEMENT OF CLAUSES.

Sect.	Preamble.	Corresponding Sections in Joint-Stock Companies Acts, 1856, 1857.
	1. Short title of Act.	
	2. Definition of Proprietary and Mutual Company	
	3. Definition of registrar.	
	4. Prohibition of insurance partnerships exceeding a certain number.	20 Vict. c. 47, s. 4.

PART I.

EXISTING INSURANCE COMPANIES.

*Registration.*Corresponding Sections in
Joint-Stock Companies
Acts, 1856, 1857.

Sect.

- | | |
|--|-------------------------|
| 5. Compulsory registration of certain Insurance Companies. | |
| 6. Penalty on Company not registering . . . | 21 Vict. c. 14, s. 28. |
| 7. Permissive registration of other Insurance Companies. | 21 Vict. c. 14, s. 29. |
| 8. Requisitions for registration by existing Proprietary Companies. | 20 Vict. c. 47, s. 111. |
| 9. Requisitions for registration by existing Mutual Companies. | |
| 10. Power for existing Company to register amount of stock instead of shares. | 21 Vict. c. 14, s. 30. |
| 11. Authentication of statements of existing Companies. | 20 Vict. c. 47, s. 112. |
| 12. Certificate of registration of existing Companies | 20 Vict. c. 47, s. 113. |
| 13. Certificate to be evidence of compliance with Act. | 20 Vict. c. 47, s. 115. |
| 14. Power of Board of Trade, in certain instances, to modify provisions with respect to existing Companies. | |
| 15. Effect of registration on deeds, &c., of Company. | |
| 16. Provisions of 11 Vict. c. 45, 12 & 13 Vict. c. 108, 7 & 8 Vict. c. 111, and 8 & 9 Vict. c. 98, not to apply to Companies registered under Act. | 20 Vict. c. 47, s. 108. |
| 17. Registration under this Act not to affect obligations incurred previously to registration. | |
| 18. Saving of liabilities of persons who were members before registration under Act. | |
| 19. Continuation of existing actions and suits. | |
| 20. Transfer of trust property to Company. | |

PART II.

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Sect.	Corresponding Sections in Joint-Stock Companies Acts, 1856, 1857.
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PART VI.

REGULATIONS APPLICABLE TO ALL LIFE INSURANCE COMPANIES.

CXXII. Every existing or future Company, whether registered or not under this Act, carrying on the business of insurance on human lives, shall, at such periods as are hereinafter mentioned, render an account, specifying the following matters (that is to say)—

- (1) A table of annual premiums used by the Company on granting assurances during the period over which the account extends for the whole term of life, distinguishing assurances with profits from assurances without profits, and including the rates at all ages for which the same are published:
- (2) The gross amount of all sums assured on lives for the whole term of life in existence on the day when the account is closed, distinguishing the gross sum assured on lives according to the ages at the date of account for each decade of life, from the youngest to the oldest ages, commencing at birth, distinguishing for each decade the amounts reassured in other offices:
- (3) The gross amount of annual premiums, distinguishing ordinary and extra premiums, receivable in respect of assurances mentioned under the last head, showing also the amounts payable to other Offices for reinsurance in each decade of life:
- (4) The gross amount of all sums assured for other periods or on other contingencies than expressed in No. 2:
- (5) The gross amount of annual premiums receivable in respect of assurances mentioned under the last head:

- (6) The gross amount of all existing and prospective reversionary additions made to policies, classified as expressed in No. 2:
- (7) The gross amount of annual deduction, permanent or temporary, by way of bonus from premiums classified as expressed under head 2:
- (8) The gross amount, if any, of immediate annuities payable on lives, distinguishing the sums payable on lives in each decade of life, commencing at birth:
- (9) A statement of paid-up capital, in shares or stock, loans to the Company and deposits, and any other classes of liabilities or engagements to which the Company may be subject, specifying their nature and amount, and also the amount of any premiums receivable on account thereof respectively:
- (10) A statement of all the capital possessed by the Company, distinguishing—
 - (a) Amount of cash;
 - (b) The cost amount of all the British or Foreign Government securities held at the date of the account, distinguishing the amount of each stock;
 - (c) The amount advanced on mortgage of freehold, leasehold, or copyhold estates, distinguishing whether in the United Kingdom or elsewhere;
 - (d) The amount invested in any other description of securities, specifying their nature and the amount invested in each class of security:

The account required to be given by this section shall be rendered once at least in every period of five years in the case of a future Company, and once at the least in every period of seven years in the case of a Company existing at the time of the passing of this Act. It shall be signed by the actuary or other principal officer of the Company: Provided, that in the case of a Company carrying on the business of insurance on lives in common with other business, the accounts required to be given by this section shall extend only to liabilities and engagements depending on life, and to the capital available for discharging the same.

CXXIII. The accounts hereby required to be given shall be forthwith sent to the Registrar of Joint-Stock Companies, whose duty it shall be to register the same.

CXXIV. If any Insurance Company makes default in preparing such accounts as aforesaid, the actuary or other principal officer of the Company shall be liable to a penalty not exceeding five pounds for every day during which such default continues; and if any Company makes default in sending copies of such accounts to the registrar, the actuary or other principal officer of the Company shall be liable to any penalty not exceeding five pounds for every day during which such default continues.

CORRESPONDENCE.

ON THE SETTLEMENT OF LOSSES BY FIRE UNDER AVERAGE POLICIES.

To the Editor of the Assurance Magazine.

SIR,—I have read with great attention the article “On the Settlement of Losses by Fire under Average Policies,” which appeared in the *Assurance Magazine* of October last, and am very glad that the complications and difficulties likely to arise from the hasty alteration of the common average clause have been so ably set forth by Mr. Atkins.

It is evident that the introduction of the “independent liability” clause has been made without due thought, and without proper regard to the interests of certainly one of the most interested parties concerned in all assurance contracts—namely, the assured.

Take, for instance, the example given in Mr. Atkins’ paper at page 9, where the case he supposes is this—

Insurances.		Property.
Office A, £5,000 docks	.	£5,000 docks.
„ G, £5,000 docks and wharves	.	£5,000 wharves.
The loss, £5,000 wharves.		

In this case, if the “independent liability” clause be acted upon in the settlement of this loss, according to the letter, in its plain and obvious meaning, and in its strict integrity, the assured, although fully covered “as far as the total amount of insurance was concerned,” would only recover *half* his loss. Office A not being interested in the wharves, the loss would fall entirely upon Office G, and would stand thus—

Amount of Goods at time of Fire.	Office G Policy.	Loss.
£10,000	£5,000	£5,000 = £2,500.

It is all very well for Mr. Atkins to argue that the Offices *must* agree to consider and treat policies having a lesser range of average as specified policies, and allow the amounts thereof to be deducted from the amount of goods at time of the fire; but this is clearly not the plain literal meaning of the “independent liability” clause; and the settlement of any loss (under policies containing this clause) in the manner proposed by Mr. Atkins, while it remains unaltered, would, in fact, be saying one thing and doing another, and thereby placing the assured in a false position with the Offices—a position to which the mercantile community will not be likely to submit when the principle becomes comprehended.

The settlement of a loss under various policies containing this clause, will, doubtless, be more just and equitable between Office and Office when all the policies include the place at which the loss may have occurred; but, as between the Offices and the assured, something must assuredly be done to remedy the defect pointed out, before another dock or wharf fire occurs.

A clause should be added to the conditions of average, to the effect that policies of a lesser range will be considered as specific assurances when they do not include the place where the loss may have happened, if the practice

suggested by Mr. Atkins is to be adopted; and then "the settlement of losses by fire under average policies" would be in conformity with the conditions, and not in opposition to them.

I am, Sir,

Your obedient servant,

R. RAY.

Atlas Fire Office,

17th November, 1858.

ON CERTAIN ADVANTAGES AFFORDED BY MR. CHISHOLM'S TABLES RECENTLY PUBLISHED.

To the Editor of the Assurance Magazine.

SIR,—In the last Number of the *Assurance Magazine*, your able correspondent, Mr. T. B. Sprague, has given a formula, adapted to the D and N columns, for obtaining the annual premium for a term assurance on two joint lives, under the impression that Mr. David Jones, in his treatise on annuities, had overlooked it. He has evidently not observed, that, in the edition of Mr. Jones's valuable work, published under the superintendence of the "Society for the Diffusion of Useful Knowledge," a list of formulæ is prefixed to the second volume, containing, amongst others, the formula, the supposed want of which excites Mr. Sprague's surprise.

It is as follows—

$$P_{m.m_1n} = r - \frac{N_{m.m_1} - N_{m+n.m_1+n}}{N_{m-1.m_1-1} - N_{m+n-1.m_1+n-1}},$$

and coincides with that given by Mr. Sprague.

Perhaps it may not be out of place here, to allude to the facilities now afforded for the solution of this and cognate problems by the valuable contribution recently made by Mr. David Chisholm to the science of Life Assurance. The M and R columns, as calculated by him, representing the contingency of survivorship, have effected a most material simplification in the methods formerly employed for finding values in which this contingency is involved, and have supplied a want which was most urgently felt. Indeed, by Mr. Chisholm's arduous labours, the commutation system, originated by Mr. Barrett, improved by Mr. Davies, and extended and illustrated by Mr. Jones, has been rendered complete in so far as relates to one and two lives.

But to return to the question alluded to at the commencement of this letter: the columns $M_{x,y}^1$ and $M_{x,y}^{-1}$, as tabulated by Mr. Chisholm, being complementary, may be used for the solution of questions connected with joint life assurances; and as these converse values are placed on opposite pages, the facility of using them is greatly increased. The formula for the annual premium for a term joint assurance is just an extension of that for single lives, being

$$\frac{M_{x,y}^1 + M_{x,y}^{-1} - M_{x+n,y+n}^1 + M_{x+n,y+n}^{-1}}{N_{x,y} - N_{x+n,y+n}}.$$

The expression for the annual premium for an assurance deferred n years is

equally simple, $\frac{M_{x+n,y+n}^1 + M_{x+n,y+n}^1}{N_{x,y}}$. If the number of premiums be limited to n , of course $N_{x,y} - N_{x+n,y+n}$ must be substituted in the denominator.

But although these tables considerably lessen the labour of solving such problems as the above, their full value cannot be appreciated, unless we compare the simplicity of the operations now required in the finding of values in which the element of survivance is introduced (which by them is reduced to a simple division), with the laborious methods which were formerly rendered necessary.

Hoping that these few remarks may turn the attention of such of your readers as have not already examined Mr. Chisholm's volumes, to the great facilities which they offer to those who are engaged in intricate calculations.

I am, Sir,

Your obedient servant,

W. F. B.

Edinburgh, 27th Nov., 1858.

DEMONSTRATION OF FORMULÆ FOR VALUE OF AN ENDOWMENT ASSURANCE.

To the Editor of the Assurance Magazine.

SIR,—It is very well known that an assurance payable at a given age or at previous death—commonly called an “endowment assurance”—bears a close analogy to an ordinary whole term assurance. This analogy has been pointed out by Mr. Gray (*Tables of Life Contingencies*, art. 233); but he has not given any of the formulæ for the assurance in question. The subject has been also touched upon by yourself—*Assurance Magazine*, vol. i., p. 332—where the proper formulæ are given and demonstrated; a formula is also supplied by Mr. Hardy in his *New and General Notation*, p. 43. The following convenient practical rule is easily seen to follow at once from the reasoning in the passage in the *Assurance Magazine* just referred to:—“To find the annual or single premium for an endowment assurance payable at the age $m+t$ on a life now aged m , calculate the temporary annuity for $t-1$ years on the life m , and enter Orchard's Tables with the result, in just the same way as for an ordinary whole term assurance.”

As assurances of the kind in question are not at all uncommon, being granted by most Insurance Companies, and the subject is therefore of some practical importance, I have thought that the following independent proof of the above rule will be interesting to the readers of the *Assurance Magazine*.

Since an endowment assurance on a life m , payable at age $m+t$, is equivalent to a term assurance for t years and an endowment at the end of t years, the single premium for it will be $\frac{M_m - M_{m+t} + D_{m+t}}{D_m}$. The annual premium is got by substituting $N_{m-1} - N_{m+t-1}$ for D_m in the denominator, and is therefore $\frac{M_m - M_{m+t} + D_{m+t}}{N_{m-1} - N_{m+t-1}}$.

But,

$$M_m = D_m - (1-r)N_{m-1},$$

$$M_{m+t} = D_{m+t} - (1-r)N_{m+t-1};$$

therefore,

$$M_m - M_{m+t} + D_{m+t} = D_m - (1-r)(N_{m-1} - N_{m+t-1});$$

and the annual premium is consequently equal to

$$\frac{D_m}{N_{m-1} - N_{m+t-1}} - (1-r), \quad \text{or} \quad \frac{1}{1 + a_{m-t-1}} - (1-r),$$

—which proves the rule stated above for the annual premium. It is also at once seen that the single premium is

$$1 - (1-r) \frac{N_{m-1} - N_{m+t-1}}{D_m} = 1 - (1-r) \left(1 + a_{m-t-1} \right);$$

—from which a similar conclusion follows.

It may here be noticed, that the formulæ and the process of solution and proof are exactly analogous when two lives are involved, as in some cases which have recently occurred to myself. Thus, an endowment assurance on two lives, m, n , will be an assurance of a sum payable at the end of a certain number (t) of years, or upon the death of either of the lives, m, n , should that occur within the t years; and is therefore the sum of a joint life term assurance and a joint life endowment. The formula for the single premium will consequently be $\frac{M_{m,n} - M_{m+t,n+t} + D_{m+t,n+t}}{D_{m,n}}$, which, as above, is equal to

$$1 - (1-r) \frac{N_{m-1,n-1} - N_{m+t-1,n+t-1}}{D_{m,n}}, \quad \text{or} \quad 1 - (1-r) \left(1 + a_{m,n-t-1} \right).$$

In order, then, to find the premium for such an assurance, it will suffice, as in the case of a single life, to enter Orchard's Tables with the annuity on the joint lives for a term of $t-1$ years.

In the last Number of the *Assurance Magazine*, I gave a proof of a formula for a term insurance on two joint lives, and stated that it was not to be found in the treatises on Life Insurance. It has since been pointed out to me by Mr. Laundry, of the Eagle Insurance Company, that the formula in question is given, but without any demonstration, in *Jones on Annuities*, vol. ii., p. v.; also in a paper by Professor De Morgan in the *Companion to the Almanac* for the year 1842, p. 2.

That I may not be indebted to Mr. Laundry without making him some return, I will supply what seems to me an omission in his communication which precedes my own, in the last Number of the *Assurance Magazine*. In treating of the question—"For what amount should a policy free from future payment of premium be given, in consideration of the surrender of an existing assurance?" he does not state how he would deduce a practical value from the theoretical one given by his formula. I presume he would take off some percentage; but the following seems the more theoretically correct method of proceeding. Let the full value of the policy be taken, and the corresponding reversion be calculated by an "Office single premium." Thus, if A'_m be the Office single premium at age m , we shall have $A'_m = (1 + a_m) P'_m$, where P'_m is the annual premium charged by the Office at the age m . Then the full value of the policy being $\Sigma = (1 + a_{m+n}) (P_{m+n} - P_m)$, where P_m, P_{m+n} are the net premiums at the ages m, n , the amount of the free policy will be $\frac{\Sigma}{A'_{m+n}} = \frac{P_{m+n} - P_m}{P'_{m+n}}$.

When the premiums charged by the Office are obtained from the net premiums by adding a percentage, the amount of the free policy, as given

by this formula, will be in the same ratio to the theoretical amount that the net premium is to the premium charged; but this will not be so when, as is often the case, the premiums are formed in some other way.

I remain, Sir,

Your obedient servant,

Liverpool and London Insurance Company,
20, Poultry, London,
4th December, 1858.

T. B. SPRAGUE.

FORMULÆ FOR THE PREMIUM FOR A TERM ASSURANCE ON TWO JOINT LIVES.

To the Editor of the Assurance Magazine.

SIR,—In the last Number of your *Journal*, your talented correspondent, Mr. T. B. Sprague, remarks, that the formulæ given by him for the single and annual premium of a temporary assurance on the joint lives of two persons may probably be *new* to the readers of the *Assurance Magazine*, as they are not given in David Jones' *Treatise on Annuities*, or in any other work with which he is acquainted. It is true that the *commutation* formulæ for joint lives do not appear in the first volume of Jones, but your readers will find them capitulated on pages 5 and 6 of the second volume of that work, also in a paper on "Life Contingencies," by Professor De Morgan, in the *Companion to the British Almanack*, for the year 1842, where the subject is treated in a very elegant and masterly style.

I know from experience that the formulæ in question do not frequently occur in practice; but it is well to know how to investigate them, inasmuch that the exact expressions are always preferable to the approximate methods, when, as in the present case, the results are not too complicated for practical use.

The mode of investigation adopted by Mr. Sprague, in your last Number, is very neat and concise, but as that method is based upon Jones' formulæ,

$$(A)_{t|} = r \{1 + (a)_{t-1|}\} - (a)_{t|},$$

the demonstration of which may be considered the most difficult part of the question, it has occurred to me that the following solution, investigated from first principles, may be acceptable to your readers.

I regret that my time has been so much occupied during the last quarter as to prevent me from continuing my paper on "Finite Differences" in the present Number; but I will, if possible, resume the subject in the *Journal* for April next.

I am, Sir,

Your obedient servant,

WM. CURTIS OTTER, F.R.A.S.

PROBLEM.

Required the single and annual premium for the assurance of £1 payable on the death of the first of two lives, A and B, aged x and y , provided such death takes place before the expiration of t years.

SOLUTION.

The payment of the £1 will evidently depend upon the probability of one or other or both of the given lives failing within t years.

Now, the probability that one or other or both of the lives are dead at the end of the n th year from the present time is equal to the probability of both the lives being in existence at the beginning of the n th year, *minus* the probability of their both being alive at the end of the n th year, the expression for which is

$$(p_{x,y,n-1} - p_{x,y,n}) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

Discounting this probability, and integrating the result between the limits assigned by the tables of mortality used, we get

$$\begin{aligned} & \sum_{n=z-x}^{n=1} (r \cdot p_{x,y,n-1}) - \sum_{n=z-x}^{n=1} (r \cdot p_{x,y,n}) \\ &= \frac{a_{x-1,y-1}}{p_{x-1,y-1,1}} - a_{x,y} \quad . \quad . \quad . \quad . \quad . \quad . \quad (2) \end{aligned}$$

and, similarly,

$$\begin{aligned} & \sum_{n=z-x}^{n=t} (r \cdot p_{x,y,n-1}) - \sum_{n=z-x}^{n=t} (r \cdot p_{x,y,n}) \\ &= r^t \cdot p_{x,y,t} \left\{ \frac{a_{x+t,y+t}}{p_{x+t,y+t,1}} - a_{x+t,y+t} \right\} \quad . \quad . \quad (3) \end{aligned}$$

but, from the construction of the annuity tables, we have

$$a_{x-1,y-1} = r \cdot p_{x-1,y-1,1} (1 + a_{x,y}),$$

therefore, by substitution in (2), we get

$$r(1 + a_{x,y}) - a_{x,y} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

$$\text{or,} \quad r \left(1 + \frac{N_{x,y}}{D_{x,y}} \right) - \frac{N_{x,y}}{D_{x,y}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

$$\text{or,} \quad \frac{r \cdot N_{x-1,y-1} - N_{x,y}}{D_{x,y}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

similarly (3) becomes

$$r^t \cdot p_{x,y,t} \left\{ r(1 + a_{x+t,y+t}) - a_{x+t,y+t} \right\} \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

$$\text{or,} \quad \frac{D_{x+t,y+t}}{D_{x,y}} \left\{ r \left(1 + \frac{N_{x+t,y+t}}{D_{x+t,y+t}} \right) - \frac{N_{x+t,y+t}}{D_{x+t,y+t}} \right\} \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

$$\text{or,} \quad \frac{r \cdot N_{x+t-1,y+t-1} - N_{x+t,y+t}}{D_{x,y}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

Formulae (2), (4), (5), and (6), represent the present value of £1 payable on the death of the first of two lives aged x and y .

Also, (3), (7), (8), and (9), represent the present value of £1 payable on the death of the first of two lives, provided that such death takes place after the expiration of t years.

Hence the difference between any corresponding pairs of these expressions is the present value of £1 payable on the death of the first of the two lives, provided such death occurs before the end of t years.

$$= \frac{r(N_{x-1, y-1} - N_{x+t-1, y+t-1}) - N_{x,y} - N_{x+t, y+t}}{D_{x,y}}. \quad (10)$$

$$\text{or,} \quad 1 - \frac{D_{x+t, y+t} - (1-r) \cdot (N_{x-1, y-1} - N_{x+t-1, y+t-1})}{D_{x,y}}. \quad (11)$$

$$\text{or,} \quad \frac{M_{x,y} - M_{x+t, y+t}}{D_{x,y}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

Since, by the construction of the commutation tables,

$$\begin{aligned} M_x &= r \cdot N_{x-1} - N_x \\ &= D_x - (1-r)N_{x-1}, \end{aligned}$$

the annual premium is obtained by dividing the preceding expressions by $(N_{x-1, y-1} - N_{x+t-1, y+t-1})$, in lieu of $D_{x,y}$.

Thus, from (10) we get

$$r - \frac{N_{x,y} - N_{x+t, y+t}}{N_{x-1, y-1} - N_{x+t-1, y+t-1}}$$

for the annual premium sought—being the same as that obtained by Mr. Sprague in the October Number of the *Journal*.

Obs.—All questions in which the joint duration of two lives occurs can always be solved most expeditiously by simply substituting $D_{x,y}$, $N_{x,y}$, &c., for D_x , N_x , &c., in the single life formulæ, and using the joint commutation tables, in lieu of the single ones, in their practical application.

Ex. gr.—The single premium for an assurance of £1 for t years, on a life aged x , is

$$\begin{aligned} A_{(x)t} &= \frac{M_x - M_{x+t}}{D_x} \\ &= \frac{r(N_{x-1} - N_{x+t-1}) - (N_x - N_{x+t})}{D_x} = 1 - \frac{D_{x+t} - (1-r)(N_{x-1} - N_{x+t-1})}{D_x} \end{aligned}$$

∴ the annual premium for the same is

$$\begin{aligned} P_{(x)t} &= \frac{M_x - M_{x+t}}{N_{x-1} - N_{x+t-1}} \\ &= r - \frac{N_x - N_{x+t}}{N_{x-1} - N_{x+t-1}} \\ &= \frac{D_x - D_{x+t} - (1-r)(N_{x-1} - N_{x+t-1})}{N_{x-1} - N_{x+t-1}}; \end{aligned}$$

hence the single and annual premiums for a similar temporary assurance on two joint lives aged x and y are—

$$\begin{aligned} A_{(x,y)t} &= \frac{M_{x,y} - M_{x+t, y+t}}{D_{x,y}} \\ &= \frac{r(N_{x-1, y-1} - N_{x+t-1, y+t-1}) - (N_{x,y} - N_{x+t, y+t})}{D_{x,y}} \end{aligned}$$

and

$$\begin{aligned} P_{(x,y)t} &= \frac{M_{x,y} - M_{x+t, y+t}}{N_{x-1, y-1} - N_{x+t-1, y+t-1}} \\ &= r - \frac{N_{x,y} - N_{x+t, y+t}}{N_{x-1, y-1} - N_{x+t-1, y+t-1}}. \end{aligned}$$

In a similar manner may all the joint life formulæ be derived from the single, without the trouble of investigating each particular case independently of the single life formulæ.

Obs.—*Formulæ* (2), (3), (4), and (7), are, I believe, *new*, as I have never seen them in any work that has come under my notice; (2) and (4) will be found very serviceable in computing a table of reversions by means of a reciprocal probability table, such as Table XXIV. given in the first volume of Jones, page 550, and the ordinary life annuity tables.

W. C. O.

ON CERTAIN COMMUTATION FORMULÆ.

To the Editor of the Assurance Magazine.

SIR,—The communications of Messrs. Laundy and Sprague,* in the last Number of the *Assurance Magazine*, have induced me to send you a few "Commutation Table" formulæ which I have had occasion to make use of in practice, and which, as not lying quite on the surface of the subject, may prove a useful contribution to those interested in them.

The notation used is that employed by Professor De Morgan, where " l_x " represents the number living at age x , " $p_{x:n}$ " the probability of a life aged x living n years, " v " = $\frac{1}{1+r}$, the present value of £1 due a year hence, &c.

1. Endowment of £1 payable to (x) if alive n years hence; premium to be returned in the event of death; p per £1 Office commission added.

$$\text{Single premium, } \frac{(1+p) D_{x+n}}{D_x - (1+p) (M_x - M_{x+n})}.$$

$$\text{Annual premium, } \frac{(1+p) D_{x+n}}{(N_{x-1} - N_{x+n-1}) - (1+p) (R_x - R_{x+n} - n M_{x+n})}.$$

2. *Life assurance*.—Annual premium payable until death, on which the whole of the premiums paid (without interest) are to be returned. Commission of p per £ on net value.

$$\pi = \frac{(1+p) M_x}{N_{x-1} - (1+p) R_x}.$$

3. Assurance for n years on (x) , with endowment payable should he survive that term, but the benefit payable only provided (y) be alive.

$$\text{Single premium, } \frac{D_{x+n, y+n}}{D_{x, y}} \cdot (1 - A_{x+n, y+n}^1) + A_{x, y}^1.$$

$$\text{Annual premium, } \{D_{x+n, y+n} (1 - A_{x+n, y+n}^1) + D_{x, y} A_{x, y}^1\} \div (N_{x-1, y-1} - N_{x+n-1, y+n-1}).$$

For the Carlisle 3 per cent. rates, the values $A_{x, y}^1$, &c., are got by inspection in Gray, Smith, and Orchard's tables.

4. Endowment of £1 payable to (y) should he survive n years, and provided (x) die before.

* Mr. Sprague has overlooked the circumstance that his (joint life) formula previously appeared in Professor De Morgan's able paper in the *Companion to the Almanac* for 1842.

To suit the published tables, the numerator must here change with the relation the ages bear to each other; thus:—

$$x < \text{or} = y. \quad D_{x, y+n} - D_{x+n, y+n}.$$

$$x < (y+n) > y. \quad v^{x-y} D_{x, y+n} - D_{x+n, y+n}.$$

$$x > \text{or} = y+n. \quad v^n D_{x, y+n} - D_{x+n, y+n}.$$

For *single premium*, the denominator must in each case be $D_{x,y}$, and for *annual premium*, $N_{x-1, y-1} - N_{x+n-1, y+n-1}$.

5. Assurance and endowment payable at the first death of (x) or (y), if within n years, or at the end of that term if they are both alive.

$$\text{Single premium, } 1 - \frac{(1-v)N_{x-1, y-1} - N_{x+n-1, y+n-1}}{D_{x,y}}.$$

$$\text{Annual premium, } \frac{D_{x,y}}{N_{x-1, y-1} - N_{x+n-1, y+n-1}} - (1-v).$$

6. *Educational endowments*.—Annual premium: k premiums in all for annuity of £1 per annum to (y), to be entered on at death of (x), if within n years, and thence to continue until annuitant attains age $y+n$.

$$x > y. \quad \frac{l_x v^{x-y} (N_y - N_{y+n}) - (N_{x,y} - N_{x+n, y+n})}{N_{x-1, y-1} - N_{x+k-1, y+k-1}}.$$

7. A current assurance for £ s on the joint lives of (x) and (y), on which an annual premium of P is payable, is to be converted into an assurance payable at the death of (x) only. The reduced premium is

$$\frac{P(1 + a_{x,y}) - s(A_{x,y} - A_x)}{1 + a_x},$$

and, in the “Commutation Table” formula, becomes

$$\frac{PN_{x-1, y-1} - s(vN_{x-1, y-1} - N_{x,y} - M_x l_y)}{l_y N_{x-1}};$$

$$\text{or, } \frac{N_{x-1, y-1} [P + s(1-v)] - s(D_{x,y} - l_y M_x)}{l_y N_{x-1}}.$$

To suit the published tables, if $x < y$, the factor “ l_y ” in the formula must, in each case, be changed to $l_y v^{y-x}$.

8. A current assurance for £ s on the life of (x), on which an annual premium of P is payable, is required to be converted into an assurance of the same amount payable at the first death of (x) or (y). Here the new benefit being of increased value, the Office commission of p per £1 on it has to be provided for, and the annual premium, payable during joint lives only, becomes

$$\frac{P(1 + a_x) + s(1+p)(A_{x,y} - A_x)}{1 + a_{x,y}};$$

or, by the “Commutation Table” formula,

$$\frac{l_y (PN_{x-1} - M_x) - s(1+p)N_{x,y}}{N_{x-1, y-1}} + s(1+p)v.$$

To suit the published tables, where $x < y$, the factor “ l_y ” must be altered to $l_y v^{y-x}$.

I am, Sir,

Your most obedient servant,

Aberdeen, 30th December, 1858.

H. A. S.

ON THE ADVANTAGES OF THE MODERN METHODS OF COMPUTATION IN LIFE ASSURANCE CALCULATIONS.

To the Editor of the Assurance Magazine.

SIR,—I observe Mr. Laundy's note and problems in the October Number, attempting to show the greater advantages of the "modern" methods of computation over the "ancient" methods, and referring to a former Number for more striking illustrations to the same effect.

I, however, cannot perceive so great advantages in the columnar system over the other to a person who possesses a set of temporary and deferred annuities for the first 20 or 30 years following each year of age. Possessing these tables, my own practice inclines to the "ancient" method. By the more modern method, I found myself continually hunting up the logarithms of the sums or differences of the D's, A's, and M's, and might, perhaps, turn up the same logarithms many, many times, in the course of a year, without advancing one step; whereas, by the ancient system, the component parts of the immediate annuity, the deferred and temporary annuities in advance and not in advance, and the endowments and their logarithms, once tabulated, are there for every future occasion. Of course, for occasional calculations at a different rate of interest, the modern or columnar system is the best. I think, however, that the Carlisle columnar system has been greatly enhanced by the few pages of the logs. of the single lives D's, A's, and M's, in Mr. Chisholm's invaluable volumes, and that it might be still further improved by the tabulation of the logs. of the *difference* of the A's.

The problems, solved according to Milne's notation, are as follow:—

1. Annual premium, P, payable $n+1$ times, for annuity of £ m deferred n years.

$$P = \frac{m \cdot \log_{n+1} a_x}{\log_{n+1} a_{x+1} - \log_{n+1} av^{n+1}} = \frac{m \cdot \log_n a_x}{1 + \log_n a_x}.$$

The addition of three logs., of which two are tabulated, solves this question. Its columnar form is* $\frac{mN_{x+n}}{N_{x-1} - N_{x+n}}$.

2. Annual premium, payable t times, for assurance of £ m for n years.

$$P = m \cdot \frac{v \{ \log_n a_{x+1} - \log_n av^n \} - \log_n a_x}{\log_t a_{x+1} - \log_t av^t}.$$

In this case, v and its log., as well as the log. of $1-v$, are as familiar as my own name. Its columnar form $= \frac{m \{ M_x - M_{x+n} \}}{N_{x-1} - N_{x+t-1}}$.

* Although the N's are here stated according to Jones' arrangement of the column, I greatly prefer to use those of Mr. Chisholm, by which

$N_x = D_x + D_{x+1} + \&c.$; and, therefore,

$$\log_n a_{x+1} - \log_n av^n = N_x - N_{x+n} \text{ in place } N_{x-1} - N_{x+n-1},$$

$$\text{and } \log_{n+1} a_{x+1} - \log_{n+1} av^{n+1} = N_x - N_{x+n+1} \quad \text{vs.} \quad N_{x-1} - N_{x+n}.$$

3. Annual premium, payable t times, for assurance of £ m payable at death or at the end of n years if then alive.

$$P = m \cdot \frac{1 - d \{ {}_n\rfloor^{a_{x+1} - {}_n av^n} \}}{{}_t\rfloor^{a_{x+1} - {}_t av^t}}.$$

The working out of this formula does not exceed that of the

$$\text{columnar form} = m \cdot \frac{\{ D_{x+n} + M_x - M_{x+n} \}}{N_{x-1} - N_{x+t-1}} = m \cdot \frac{D_x - d \{ N_{x-1} - N_{x+n-1} \}}{N_{x-1} - N_{x+t-1}}.$$

4. Conversion of policy for £ m payable at death of x , at a premium P , into another policy for £ m payable at death, or in n years if then alive, at a premium P' . Required the premium P' to be payable for n years.

$$x \text{ receives} \quad m \{ 1 - d \{ {}_n\rfloor^{a_{x+1} - {}_n av^n} \} \} + P(1 + a_x)$$

$$\text{and gives up} \quad m \{ 1 - d(1 + a_x) \} + P' \{ {}_n\rfloor^{a_{x+1} - {}_n av^n} \}$$

$$\therefore P' = \frac{m \{ 1 - d \{ {}_n\rfloor^{a_{x+1} - {}_n av^n} \} \} + P(1 + a_x) - m \{ 1 - d(1 + a_x) \}}{{}_n\rfloor^{a_{x+1} - {}_n av^n}}$$

$$P' = \frac{P(1 + a_x) + md \{ {}_n\rfloor^{a_x + {}_n av^n} \}}{{}_n\rfloor^{a_{x+1} - {}_n av^n}} = \frac{(P + md)(1 + a_x)}{{}_n\rfloor^{a_{x+1} - {}_n av^n}} - md;$$

$$\text{its columnar form being} \quad = \frac{PN_{x-1} + m \{ D_{x+n} - M_{x+n} \}}{N_{x-1} - N_{x+n-1}},$$

$$P' = \frac{PN_{x-1} + md \{ N_{x+n-1} \}}{N_{x-1} - N_{x+n-1}} = \frac{(P + md)N_{x-1}}{N_{x-1} - N_{x+n-1}} - md.$$

5. Conversion of policy for £ m on age x , payable at death, or at age $x+n$ if alive, for an annual premium of P until age $x+n-1$, into a policy for £ m payable at death. Required the premium P' to be payable during life.

$$x \text{ receives} = m \{ 1 - d(1 + a_x) \} + P({}_n\rfloor^{a_{x+1} - {}_n av^n}),$$

$$\text{gives up} = m \{ 1 - d \{ {}_n\rfloor^{a_{x+1} - {}_n av^n} \} \} + P'(1 + a_x),$$

$$\therefore P' = \frac{P({}_n\rfloor^{a_{x+1} - {}_n av^n}) - md \{ {}_n\rfloor^{a_x + {}_n av^n} \}}{1 + a_x} = P - \frac{(P + md)({}_n\rfloor^{a_x + {}_n av^n})}{(1 + a_x)}$$

$$= \frac{(P + md) \{ {}_n\rfloor^{a_{x+1} - {}_n av^n} \}}{(1 + a_x)} - md;$$

$$\text{its columnar form being} = \frac{P \{ N_{x-1} - N_{x+n-1} \} - m \{ D_{x+n} - M_{x+n} \}}{N_{x-1}}$$

$$= P - \frac{(P + md)(N_{x+n-1})}{N_{x-1}}.$$

6. Conversion of policy for £ m at a premium P into policy for £ m free of premiums. Age now $x+n$.

$$\begin{aligned}
 x+n \text{ receives} &= m'(v - da_{x+n}) + P(1 + a_{x+n}), \\
 \text{gives up} &= m(v - da_{x+n}), \\
 \therefore m' &= \frac{m(v - da_{x+n}) - P(1 + a_{x+n})}{v - da_{x+n}} \\
 &= m - \frac{P(1 + a_{x+n})}{v - da_{x+n}} \\
 &= m - \frac{P^x}{P_{x+n}}.
 \end{aligned}$$

Upon the whole, I think many of your readers will admit, that, with a complete set of temporary annuities, the foregoing problems, as expressed and solved by the columnar notation, do not show any material advantage over the notation adopted by

“JOSHUA MILNE.”

Edinburgh, November, 1858.

INSTITUTE OF ACTUARIES.

PROCEEDINGS OF THE INSTITUTE.

First Ordinary Meeting, Session 1858.—Monday, 29th November, 1858.

CHARLES JELlicoe, Esq., Vice-President, in the Chair.

The minutes of the last annual general meeting were read and confirmed.

The Secretary announced various donations to the library.

Mr. Farren read a paper “On the improvement of life contingency calculations. (Part II.) The system of dependent risks.”

Second Ordinary Meeting, Session 1858.—Monday, 27th December, 1858.

ROBERT TUCKER, Esq., Vice-President, in the Chair.

The minutes of the last ordinary meeting were read and confirmed.

The Secretary announced several donations to the library.

The following candidates, duly nominated at the last ordinary meeting, were elected members of the Institute, viz. :—

Official Associate—Benjamin Henderson.

Associates.

Reginald Horace Allen.
William Booth.
Thomas Hindhaugh Fleming.
William Matthew Makeham.

John Saunders Muir, F.R.A.S.
William Charles Mullins.
George Charles Silk.
William Seaman Thomson.

William George Wilks.

Mr. Hodge read a paper “On the rates of interest for the use of money in ancient and modern times. (Part III.)”

THE
ASSURANCE MAGAZINE,
AND
JOURNAL
OF THE
INSTITUTE OF ACTUARIES.

*On the Improvement of Life Contingency Calculation. Part II.:
The System of Dependent Risks. By EDWIN JAMES FARREN,
Fellow of the Statistical Society and of the Institute of Actuaries.*

[Read before the Institute of Actuaries, 29th November, 1858, and ordered by
the Council to be printed.]

IN the former paper,* it was laid down, as the basis of any improvements I might be able to suggest as to life contingency calculation, that, in place of premises of a specific nature leading to special conclusions, we should rather, from the very commencement, recognise the variable nature of the results we might have to encounter, and accordingly construct a system of limits rather than one of particular values.

Speaking geometrically, the prevailing doctrine starts with the assumption that the so-called law of mortality, and, indeed, of interest of money, can be represented by a single line, and that its exact course can be predicated. The effect of such an assumption is at once to present the system as one wholly confined to one particular branch of the exact sciences; the resulting values being, in fact, no more than the representative details of a certain function dependent on the exact nature of the particular line chosen, and taken as the emblem of the law of mortality itself. Thus we have Halley's Breslau Table virtually symbolized by the harmonical line

* *Journal*, vol. v., p. 185.

or theory of De Moivre ; Simpson's London Table, by the function of Lambert ; the Carlisle Table, by that of Gompertz ; the Equitable Experience, by that of Dr. Young ; and, incidentally, the Northampton—and, indeed, nearly every other mortality table of fixed values—by various functional or equational contrivances which can practically be substituted for the table itself.

It is desirable to draw attention very prominently to these substitutions of processes for each other, leading either identically, or in the spirit of identity, to certain fixed results, because it is this very fixity that has falsely given what I have ventured to call elsewhere so “wooden” an appearance to many of our existing processes and calculations.

Speaking also geometrically, the system now proposed, instead of a single line, would require two, between which, sometimes towards the one and sometimes towards the other, the line of results, as they actually occurred from time to time, might be expected to unfold itself, but without any necessary intrinsic property of being exactly predicated. Instead, therefore, of expressing a fixed law of mortality or of interest of money, supposed to be equally prevalent in all Societies and on all occasions, for all periods, however long or however short, the primary conditions, as now proposed, would be fulfilled, whether the law were variable or invariable, or whether there were or were not any primary law whatever, so long as the results themselves, whether in one Society or another, did not fall beyond the expected limits of fulfilment.

It would, therefore, be to these limits, rather than to any primary special values, that our original predications and attention would have to be more particularly directed.

In place of such defined limits, the only substitute we have hitherto had is the application of the term “average” to some favourite special rate, whether of mortality or interest. This favouritism, in some cases, has even been pushed so far as to have induced, as mentioned in the former paper, the adoption and application of the epithets “true rates” or “real rates”* to what should really be considered as merely partial exhibitions of values ; essentially variable in their nature, even in the same Society, and by no means, therefore, of such authoritative character as to warrant the assumption of absolutism, or to exclude the adoption of other rates equally “true” or equally “real” in a similarly limited sense.

It is also to be remembered, that the extension now proposed of the premises from which the particular algorithm of life con-

* See “Postscript,” vol. v., p. 194.

tingencies should be made to flow, is only a change of a cognate kind to that to which the great algorithm of symbolical algebra itself has been made subject even in our own time. Formerly, in following out the algebraical deductions resulting from the ordinary "rule of signs," values were arrived at, which, for the time being, even in the best mathematical treatises, home or foreign, were coupled with no better interpretative terms than those of "imaginary" or "impossible." The remedy for this class of anomalies—as I think it will be found with the anomalies in our own subjects—has been to openly give a greater scope to the original premises themselves, and thereby to include results within the laws of intelligible interpretation that otherwise might be said to be wholly beyond it.

Not to mention minor anomalies with which the actuary has at present to deal, I shall confine myself to drawing attention to what may be considered the greatest of all, arising out of the prevailing system of calculation, and which has, indeed, prompted the preparation, and forms the object of illustration, of the present paper. I allude to the circumstance of the prevailing system, even as displayed in our text-books, being essentially one merely of prices or premiums, and but little, if at all, one of practical insurance finance.

Tables of prices we have in abundance, even to the remotest decimal; and formulæ for their determination in conjunction with the most unusual combinations of lives and ages; but anything approaching a system for the due appreciation and treatment of results, as they occur from time to time in the same Society or different Societies, it may be fairly said we have not, nor indeed can we have, until our present system of calculation is considerably extended in its first principles, or enlarged by the addition of supplementary methods for the after-finance of phases of results.

It is, indeed, true that a system of calculation which should, in the widest sense of the term "proper," be "proper" to determine the rates of premium or prices to be charged for various risks to be incurred or surrendered, should also be sufficiently comprehensive to include within itself the necessary elements for directing us how to cope financially with the results or risks themselves, after they have been incurred and are in process of occurrence; and did the prevailing system, in its present form, afford this, but little, if any, change of procedure would be needed. But it is the object of the present paper to show that the prevailing system, as commonly explained, is merely one of what may be called "*dependent risks*,"

from its illustrating in its calculative form but one line of special or predicated results, and not, as a system of "*independent risks*" would do, a variety of results, such as different Societies charging the same premiums, or even the same Society at different periods, has been found to afford.

To treat such a topic as that of dependent and independent risks, in its utmost generality, would be tantamount to writing a treatise on insurance calculation ; for it is obvious that fulfilment in the payment of occurred risks, whether originally dependent or independent of each other, is the main object of all Societies, whether for life, fire, marine, or other applications of the doctrine of insurance. Without professing to now attempt such a task, still it is because I hope it may be considered that the time has arrived for a comprehensive treatise to be written, if not by one, at least by a combination of persons; and that life insurance should be definitively shown to be but part of the great and general doctrine of independent risks, that I am anxious, as far as lies within my own power and opportunity, to direct attention, by occasional papers like the present, to the fact of how needlessly life contingency calculation has been restricted in value to insurance managers, by a speciality of premises which only provides formulæ for the determination of prices, and leaves the great questions of financial status almost untouched.

In illustrating the system of dependent risks, as now generally employed, I shall do so by the adoption of a mechanical procedure, thereby showing its confined nature, and therein, as I conceive, sufficiently illustrating its unfitness to grapple with those forms not so much bearing upon the attributes of the exact or abstract sciences as on the sciences of observation, which alone can fairly comprise all the features of the case as presented by the results of the various Societies which now are, or may be hereafter, in practical operation.

The usual illustration for a mechanical system of chances, is that of an urn, as a receptacle from which a variety of balls can be taken. I shall adopt the same illustration in principle ; but, to render cases of high numbers somewhat more readily imagined, shall consider the receptacle a common large-sized box for wafers, and the balls the very smallest dark and light-coloured beads, a collection of which, I believe, containing many hundreds, does not exceed a single ounce in weight. We may suppose 10,000 of these to be mixed and placed in a box, and to comprise 8,461 light-coloured and 1,539 dark-coloured beads. The chance of a person

blindfolded drawing a light colour would obviously be $\cdot8461$, and a dark colour $\cdot1539$. If the venture be taken in each case to be for £1, to be payable one year after the drawing, and money to bear 3 per cent., the *immediate* price for the one chance would be $\cdot8461 \times \cdot9708$, and for the other $\cdot1539 \times \cdot9708$.

If, at the end of the original year, we suppose a new drawing to take place, but to be limited to those who did not draw a dark-coloured bead in the first venture, and the total number of beads to be now limited to 8,461, the former number of the light-coloured, but of which 7,779 only should now be light, and 682 changed for dark-coloured, and the £1 in the second case not to be payable until the end of the second year, then the *immediate* price or premium for the chance of drawing a light colour at the second venture would be $\cdot7779 \times \cdot9425$, and of a dark colour $\cdot0684 \times \cdot9425$; and pursuing a similar system for a third year, under similar restrictions, using 7,779 as the new total number of beads, of which 7,274 should be light, 505 dark, and discounting for three years, the *immediate* prices or premiums would be $\cdot7274 \times \cdot9151$ and $\cdot0505 \times \cdot9151$.

It is sufficient to show the principle, to restrict the illustration to the three preceding ventures; but it is obvious that a complete series of successive ventures might also be arranged for each following year, until the original number of 10,000 should be completely exhausted or placed aside, which, in the present instance, may be supposed achieved in 104 drawings or sets after the original.

It is also obvious, that prices or premiums could be arranged for parties wishing to enter at the beginning or midway in the series of ventures, and for the whole series or for a part; that such premiums might be arranged to be made yearly, half-yearly, or quarterly; that premiums for joint ventures, and for contingent ventures of one party drawing a light bead before another should draw a dark one, or *vice versa*, could also be arranged. That, finally, we might, by mechanical means and under other names, display by aid of any such series of fixed numbers all the usual calculations appertaining to so-called tables of mortality, as now employed and used by Offices.

Further, if we pass from prices or premiums to fulfilments, it is manifest that the grantor of the ventures at fixed ratios can be in need of no capital, and can therefore be under no anxiety as to the discharge of his liabilities, so long as the system be throughout one of "*dependent risks*," that is, a system in which the happening of a defined number of particular risks restricts the possibility of

others happening. And it is upon this supposition of speciality of results that tables of mortality, of which the above mechanical illustration is an imitation (the numbers chosen being identical with those of the Carlisle Table), have hitherto been founded, and serves as the virtual plea for the non-inclusion in our text-books on insurance of the consideration of extraneous capital, number of lives concerned, insufficiency or surplusage of funds, and other topics of insurance finance of the highest practical importance.

To show such non-inclusion can only be justified by considering the prevailing system as one of dependent risks, it will only be necessary to glance at the difference of position in which the grantor of the same ventures is immediately placed, if he be openly considered as pledging himself to a system of independent in lieu of that of dependent risks. For example: in the venture of the original 10,000 risks already alluded to, if such be considered as dependent risks, or so arranged that no other result but that of 1,539 dark beads, for instance, can possibly ensue, as would necessarily result if each bead of the 10,000, on being drawn, were put aside before the next were drawn, then not only would the prices quoted be the fair premiums for the risk, but the amount of prices or premiums received would exactly balance the amount demanded in payment of claims. But if the 10,000 risks be rendered independent of each other, as would be the result if each bead, on being drawn, in place of being put aside, were returned to the box prior to the next drawing, so as to keep the risk the same during each set of drawings; then, although the prices or premiums would be identically the same, as a matter of theory, as before, yet, in practice, the results might be essentially different.

For it is apparent, that each person might then draw a light colour, and thus relieve the grantor of the ventures from all payments whatever, if the ventures were on the dark beads; or in the event of each drawing producing a dark colour, a considerable loss would incur beyond the amount of the prices or premiums paid for the ventures; and thus the question of extraneous capital would be at least raised as a necessary topic for consideration in any system of calculation professing to deal with the subject in its entirety.

Without, then, going further at present into the distinctive features of the two systems of dependent and independent risks, it will have been sufficient for the purposes of the present paper to have drawn attention to the material fact, that the prevailing system is really one merely of dependent risks, by its wholly ignoring the necessity of extraneous capital, or even considering the question,

and that it therefore does not fairly meet the requirements of Insurance Company problems, fully considered. Further, that to improve such a system, not merely methods of determining the relative prices or premiums for one contingency as compared with another must be involved, but also methods for marshalling results, whether in excess or defect, that may not be in exact accordance with the prices or premiums originally charged.

In a subsequent paper on independent risks, conjoined with a doctrine of limits, I shall at least be able, I trust, to take the first step towards showing that a system, sufficiently combining these requirements, is not, even in practice, wholly beyond our reach. In the mean time, I may be allowed to remark, that, however well the prevailing system may have on occasions appeared to have fulfilled its purpose, it has almost always only done so by including an element upon which dependence can no longer be placed. I allude to what have been called "errors on the safe side," or exaggerations of the primitive ratios. So long as such errors were allowed to remain on the so-called safe side—if errors can ever be said to be safe in any sense—so long a somewhat crude system of calculation might be allowed with some impunity. But when, in the face of competition for public favour, and under the name of the bonus system and distribution of profits, such exaggerations themselves have had, and still have, to be dealt with and distributed, any presumptions of safety that might otherwise have arisen under the plea of excess of caution are in constant danger of becoming elements of evil, by some counter process or procedure which a more comprehensive system of calculation would have rendered unnecessary, or, if necessary, would have legalized.

On the Determination of the Rates of Premium for Assuring against Issue. By ARCHIBALD DAY, *Actuary of the London and Provincial Law Assurance Society and Fellow of the Institute of Actuaries.*

[Read before the Institute, 31st January, 1859, and ordered by the Council to be printed.]

AMONG the numerous classes of risks now undertaken by Insurance Companies, those against the contingency of leaving issue are beginning, from their increasing numbers, to assume a position of greater importance than heretofore. Nothing has hitherto, to my

knowledge, been written upon the subject, and the premiums for insurances of this nature have been left to the judgment of the actuary as each individual case has come before him, there being no recognized and accurate formula for the calculation of the risk. Under these circumstances, and as a considerable amount of material exists from which approximate results may be deduced, I venture to submit to the Institute a few considerations upon the subject, but confined principally to the probabilities of marriage so far as they affect the calculation of such premiums.*

It will, I think, be generally allowed, that insurances payable upon the death of a person, in the event of his leaving issue surviving, form a very legitimate class of business. The proposer is generally the person next in succession, in the event of the life to be insured dying without issue, and his object is frequently to perfect a security in borrowing money upon his contingent reversion. A policy of this nature would hardly be taken out as a speculation by the tenant for life himself, as the sum assured not being payable until death, he would personally have no interest in it; but, at the same time, there is, of course, great room for fraud in this, as well as in almost every class of insurance transactions. Proposals, practically, seldom come before Assurance Societies unless there is a reasonable prospect that the reversioner will come into possession—arising either from the advanced age of the tenant for life, or from his having passed a long period of married life without family, or from the death of children who would otherwise have succeeded—the youngest age, in my recollection, upon which such a risk has been undertaken, being 48 years. In most instances, the life has been at the time married; but cases have occasionally occurred in which he has been either a bachelor or widower—the risk being then, of course, considerably increased.

In the observations following, the husband and wife are both assumed to be alive at the time of granting the insurance; and it is further assumed, as, in fact, is almost always the case, that the chances of issue by the existing marriage are too remote to affect the rate of premium to be charged.

* The following passage, which occurs in the article in the *Edinburgh Review* just published on Life Assurance, refers to the present subject:—

“Amongst the more curious cases occasionally brought before actuaries are those professionally called issue cases. The individual entitled to a life interest in a certain property, if another now in possession of it should die without leaving issue, may resort to a Life Office to raise money upon his contingent life interest—to effect which he must assure against the life tenants leaving issue. Sometimes such contingency is naturally very remote, but the transaction being peculiar, premiums of 20s., 30s., or even 40s. per cent. per annum have been demanded for such assurance, probably because actuaries have been unable to obtain a close approximation to the actual risk.”

It would probably be found that great differences exist in the methods hitherto adopted in the calculation of the premiums; but, I believe, a rough approximation has not unfrequently been obtained from the following method:—Allowing that no issue would arise by the existing marriage, the risk would terminate in the event of the husband dying before the wife; the premium charged has therefore been that for a sum payable on the death of the husband, provided he died after the wife, and, making the assumption that it is an even chance that he would remarry and have issue by the second wife, is represented by the formula—

$$\frac{1}{2} A_{HW}^{(2)}, \text{ or } \frac{1}{2} (A_H - A_{HW}^{(1)}).$$

Probably other methods, with which I am not familiar, may be disclosed if any discussion should arise upon this paper. Inquiries having become more frequent as to the rates which would be charged for cases of this description, led me to reflect whether some method could not be found to provide for the contingency, with somewhat less of the arbitrary character of the foregoing; and the results I obtained, aided by the kind suggestions of my friend Mr. Bailey, are now offered to the Institute.

In the lucid Reports of the Registrar-General will be found tables of the number of marriages contracted in each year, in a considerable proportion of which the respective ages (within quinquennial periods) of both husband and wife are distinguished. In the year 1851, the total number of marriages that were solemnized was 154,206, and of these the ages of both parties were given, in 56,347 instances, or rather more than one-third of the whole number.

Of these there were—

Bachelors . . .	48,555	Spinsters . . .	51,141
Widowers . . .	7,792	Widows . . .	5,206
	<hr/>		<hr/>
	56,347		56,347

It may fairly be assumed, that, in the cases of those whose ages were not known, the numbers at each quinquennial period would bear the same proportion to the total number as in the instances where the ages of both were given.

From Table No. VII. of the Summary Tables appended to the Report of the Census Commissioners, 1851, headed, “Civil Condition of the People,” we obtain the number of males and females living in that year, married and unmarried, for every five years of age, and from these two sources the following table has been constructed:—

TABLE I.

Age.	NUMBER LIVING, 1851.			ACTUAL MARRIAGES IN 1851, WHERE AGES OF BOTH HUSBAND AND WIFE WERE GIVEN.			ESTIMATED MARRIAGES IN 1851.		
	Bachelors.	Widowers.	Total Number of Males Unmarried.	Bachelors.	Widowers.	Total.	Bachelors.	Widowers.	Total.
15-	869,325	76	869,401	1,477	..	1,477	4,035	..	4,035
20-	633,842	2,168	636,010	26,008	241	26,249	71,049	667	71,716
25-	308,363	8,290	316,653	13,781	1,072	14,853	37,647	2,967	40,614
30-	159,956	14,249	174,205	4,597	1,474	6,071	12,558	4,079	16,637
35-	95,889	18,584	114,473	1,600	1,364	2,964	4,371	3,775	8,146
40-	67,380	24,576	91,956	690	1,230	1,940	1,885	3,459	5,344
45-	47,522	27,172	74,694	252	870	1,122	688	2,407	3,095
50-	37,155	34,057	71,212	96	703	799	262	1,945	2,207
55-	25,815	32,586	58,401	33	377	410	90	1,043	1,133
60-	21,649	41,725	63,374	12	263	275	33	728	761
65-	13,055	37,567	50,622	7	117	124	19	324	343
70-	9,629	39,284	48,913	1	45	46	3	124	127
75-	5,068	28,139	33,207	1	10	11	3	28	31
80 and upwards)	3,111	25,453	28,564	..	6	6	..	17	17
	2,297,759	333,926	2,631,685	48,555	7,792	56,347	132,643	21,563	154,206

The women who became wives in 1851, and whose ages were given, are classified in the following table. It does not affect any of the present calculations, but may perhaps be useful in future operations.

TABLE II.

Age.	Spinsters married to Bachelors.	Spinsters married to Widowers.	Widows married to Bachelors.	Widows married to Widowers.	Total.
15-	6,699	155	5	..	6,859
20-	26,397	1,253	255	64	27,969
25-	9,337	1,281	578	222	11,418
30-	2,588	1,004	685	462	4,739
35-	764	606	429	519	2,318
40-	251	401	269	531	1,452
45-	75	189	125	425	814
50-	16	78	47	294	435
55-	4	31	20	164	219
60-	2	7	7	73	89
65-	1	1	1	19	22
70- ....	..	..	..	7	7
75- ....	..	..	..	3	3
80 and upwards }	..	1	..	2	3
	46,134	5,007	2,421	2,785	56,347

It may be thought that the marriages of a single year are insufficient data for the foundation of a table of probabilities, and, I confess, that it was from the convenience alone of the census of 1851, giving the exact number living in that year, that I was, in the first instance, led to adopt the marriages of that year only, as the basis of my calculations.

A reference, however, to two most interesting papers, by Mr. Samuel Brown, published in the *Assurance Magazine*, one of which, "On the Uniform Action of the Human Will," was read before this Institute in May, 1852, and the second, "On the Proportion of Marriages at different Ages of the Sexes," before the British Association, at Dublin, in August, 1857, showing how uniform are the proportions of marriages from year to year, convinced me that the results obtained from the single year 1851 would be sufficiently accurate for my present purpose.

Mr. Brown has given tables, deduced from the Registrar-General's Reports, of the proportion per cent. which the number of marriages in each of the following classes bears to the total number; and of the proportion per cent. of marriages at four periods of age. To these I have added, in the last column, the proportions for the year 1851 alone, which will be found very closely to correspond.

Proportion per Cent. of Marriages.

	1846-7-8.	1851-2-3.	1851.
Bachelors with Spinsters	83·515	82·578	81·88
Bachelors with Widows	3·735	4·211	4·30
Widowers with Spinsters	8·401	8·504	8·87
Widowers with Widows	4·349	4·707	4·95
	100·000	100·000	100·00
Husbands under 30	76·770	75·624	75·56
30 to 45	18·310	19·219	19·49
45 to 60	4·031	4·248	4·13
60 and upwards	·889	·909	·82
	100·000	100·000	100·00

I am confirmed in my opinion of the sufficiency of the data, by a comparison which Dr. Farr has instituted between his two English Life Tables. The first was constructed from the numbers living in 1841, and the deaths in that year alone; and the second, from the population in 1841, and the deaths in the seven years, 1838 to 1844, inclusive.

AGES.	EXPECTATION OF LIFE.		VALUE OF £1 ANNUITY.	
	E. L. T., No. 1.	E. L. T., No. 2.	E. L. T., No. 1.	E. L. T., No. 2.
10	47·08	47·47	23·033	23·204
20	39·88	39·99	21·177	21·233
30	33·13	33·21	19·135	19·194
40	26·57	26·46	16·721	16·669
50	20·03	19·87	13·737	13·627
60	13·59	13·60	10·060	10·057
70	8·52	8·55	6·652	6·684

The differences between these tables, founded on deaths, being so trifling, it may reasonably be anticipated that results founded on marriages would bear an equally favourable comparison; in support of which I may adduce the testimony of M. Quetelet, who has shown that in Belgium, during 20 years, the extreme variation in the total number of marriages, from year to year, was little more than half the difference of the extremes in the number of deaths in the same period.

As the event by which the Insurance Company would become liable, could only occur through marriage with a woman of child-

bearing age, it had been my original intention to exclude those marriages where the age of the wife was above 50 years, but finding that they amounted to less than $1\frac{1}{2}$ per cent. on the total number, and looking with some slight suspicion on the ages of ladies as given in marriage certificates, I considered it would be safer to take the probability of marrying at all, regardless of the age of the wife.

The following table of the probability of bachelors, widowers, and of the two combined, marrying in the year, has been constructed from Table No. 1.

AGE.	PROBABILITY OF MARRYING IN A YEAR.		
	Bachelors.	Widowers.	Bachelors and Widowers combined.
20-	·11209	·30766	·11276
25-	·12209	·35791	·12326
30-	·07851	·28627	·09550
35-	·04558	·20313	·07116
40-	·02798	·14075	·05811
45-	·01448	·08858	·04144
50-	·00705	·05711	·03099
55-	·00349	·03201	·01940
60-	·00152	·01745	·01201
65-	·00146	·00862	·00677
70-	·00031	·00316	·00260
75-	·00059	·00100	·00093
80-	·00000	·00067	·00060

This table exhibits results of a rather startling character. In the first two quinquennial periods, the probability of a widower marrying in a year is nearly three times as great as that of a bachelor. At 30 it is nearly four times as great; from 30 to 45 it is five times as great; and it increases, until at 60, the chance of a widower marrying in a year is eleven times as great as that of a bachelor. It is curious to remark, from this table, how confirmed either class becomes in its condition of life—how little likely, after a few years, is a bachelor to break through his settled habits and solitary condition; and, on the other hand, how readily in proportion does a husband contract a second marriage who has been deprived prematurely of his first partner.

After the age of 30, the probability of a bachelor marrying in a year diminishes in a most rapid ratio. The probability at 35 is not much more than half that at 30, and nearly the same proportion exists between each quinquennial period afterwards. Many

curious speculations as to the social condition might be founded on these results, upon which, however, it is not my province to enter.

The following table, showing the probability of a widower of every age above 40 marrying in a year, has been derived from the previous results by the method of interpolation by third differences—lives under 40 years of age having been omitted as seldom coming practically before us, and the marriages in each quinquennial period, according to Dr. Farr's tables, having been taken to represent the marriages at the youngest age of that period.

PROBABILITY OF A WIDOWER MARRYING IN A YEAR.							
40	·14075	50	·05711	60	·01745	70	·00316
41	·12800	51	·05107	61	·01542	71	·00246
42	·11652	52	·04557	62	·01352	72	·00190
43	·10620	53	·04058	63	·01175	73	·00147
44	·09693	54	·03607	64	·01011	74	·00117
45	·08858	55	·03201	65	·00862	75	·00100
46	·08197	56	·02852	66	·00721	76	·00085
47	·07549	57	·02534	67	·00597	77	·00074
48	·06197	58	·02245	68	·00489	78	·00068
49	·06304	59	·01983	69	·00396	79	·00066
						80	·00067

There is at present hardly sufficient data from which to calculate the probability of issue from second marriages, and that part of the question must still be solved by conjecture; but, as it will be allowed that one of the principal items composing the risk to be borne by Assurance Societies will be that of the husband contracting a second marriage, the theory which I now propose is the assumption that the amount assured will absolutely become payable on the happening of that event. Rough as this approximation appears, the resulting premiums are still very much below what may be considered the present market price.

Assuming, then, that husband and wife are both alive, and that issue by the present marriage is impossible, the payment of the sum assured at the end of the n th year will depend—1, on the wife having died in or before the n th year; 2, on the husband surviving; and 3, on the widower remarrying in the year. The expression for the value of the payment at the end of the n th year will, therefore, be

$$p_{H,n}(1-p_{W,n})\phi_{H+n-1}r^n,$$

H and W representing the respective ages of husband and wife, and ϕ the probability of a widower marrying in a year.

The summation of these terms for every year will give the single premium for an assurance payable whenever the second

marriage takes place. The formula is not strictly accurate, as the probability of the wife dying extends to the end of the n th year, and the probability of the marriage of the widower cannot commence until after the death of the wife. The error is on the safe side, and is, I believe, immaterial.

The following table has been constructed from the probabilities of living derived from the English Life Table (No. 1), males and females, and 3 per cent. is the rate of interest assumed.

Present Value of £1 payable at the end of the Year in which a Husband shall contract a Second Marriage. English Life Table. Interest 3 per Cent.

AGE OF HUSBAND.	AGE OF WIFE.								
	40.	45.	50.	55.	60.	65.	70.	75.	80.
40	·09090	·10414	·12676	·16951					
45	·04928	·05595	·06940	·09090	·12482				
50	·02452	·02760	·03283	·04458	·06197	·08361			
55	·01098	·01226	·01450	·01959	·02757	·03798	·05110		
60			·00559	·00757	·01075	·01502	·02056	·02738	
65			·00181	·00241	·00345	·00490	·00679	·00922	
70			·00046	·00063	·00089	·00130	·00184	·00250	·00337
75					·00020	·00029	·00041	·00058	·00081

The calculations were made by aid of the perforated cards first introduced by Mr. Peter Gray—for which, and for the numerous other methods he has invented for the diminution of labour in the construction of tables, actuaries and computers are infinitely indebted. The expression given above is divisible into two parts, the one relating to the husband and the other to the wife; and for each a card has been prepared, as in the following diagram, representing the logarithms of the probabilities at each year of age. A husband of any given age may thus be combined with a wife of any other.

By combining the cards, according to the diagram, and by a simple addition of the quantities for each year throughout, as in the example, a column will be formed, upon removing the cards, representing the logarithms of the present value of the payment in each year. The natural numbers are then to be found, the sum of which will be the single premium for the risk. I should mention that, in this operation, I have used Professor De Morgan's card of four figure logarithms, the use of which would, I feel sure, be far more general were its existence better known.

1.

H 50.

 $\bar{5} \cdot 7007$ $\lambda p_{50, 30} r^{30} \phi_{79}$ $\bar{5} \cdot 7871$ $\lambda p_{50, 29} r^{29} \phi_{78}$ $\bar{5} \cdot 8927$ $\lambda p_{50, 28} r^{28} \phi_{77}$ $\bar{4} \cdot 0175$ $\lambda p_{50, 27} r^{27} \phi_{76}$ $\bar{4} \cdot 1489$ $\lambda p_{50, 26} r^{26} \phi_{75}$

2.

W 50.

 $\bar{1} \cdot 8932$ $\lambda(1 - p_{50, 30})$ $\bar{1} \cdot 8763$ $\lambda(1 - p_{50, 29})$ $\bar{1} \cdot 8579$ $\lambda(1 - p_{50, 28})$ $\bar{1} \cdot 8379$ $\lambda(1 - p_{50, 27})$

3.

W 50.

H 50.

 $\bar{5} \cdot 7007$ $\bar{1} \cdot 8932$ $\bar{5} \cdot 5939$ $\bar{5} \cdot 7871$ $\bar{1} \cdot 8763$ $\bar{5} \cdot 6634$ $\bar{5} \cdot 8927$ $\bar{1} \cdot 8579$ $\bar{5} \cdot 7506$ $\bar{4} \cdot 0175$ $\bar{1} \cdot 8379$ $\bar{5} \cdot 8554$ $\lambda p_{50, 30} r^{30} \phi_{79}$ $\lambda(1 - p_{50, 30})$

The net premiums thus obtained would be loaded according to the discretion of the actuary employing them; and as it is an established rule that all special premiums should be taxed in this respect more severely than others, I have assumed in the following comparisons an addition of 100 per cent. The examples given are cases in which large reassurances have been effected, and the premiums may, therefore, be considered to have had the approval of more than one actuary.

EXAMPLE I.

Husband aged 48, wife 54. Sum payable on death of husband in the event of issue surviving, or having attained the age of 21 in lifetime of the father. Single premium charged	£14	0	0	per cent.
Premium for a sum payable in the event of the second marriage of husband	11	19	0	„

EXAMPLE II.

Husband 60, wife 56. Sum payable on death of husband, in the event of male issue surviving. Single premium charged . . .	£10	0	0	„
Single premium for a sum payable in the event of second marriage of husband	1	13	0	„

EXAMPLE III.

Husband 78, wife 63. Sum payable at death of husband, in the event of male issue surviving. Single premium charged . . .	£5	5	0	„
Single premium for a sum payable in the event of second marriage of husband	{ A merely nominal sum (about 1s.)			

Although these differences border upon the marvellous, and the new rates will probably be deemed impracticable, I cannot but think they should be sufficient. The objections urged would probably be:—1. That the numbers in this class of insurances would be too small to form an average. 2. That the probabilities of marriage among the class of persons to which these risks are restricted would, perhaps, be greater than those of the general population. 3. That there would be greater liability to fraud in these than in ordinary insurances.

Upon the other hand, the suggested premiums assume that the sum assured would become payable on re-marriage, independent of issue; and they have further been subjected to an exceptional loading, surely sufficient to counterbalance the above objections.

I have little doubt that the probabilities of marriage among the

higher classes would be found to be greater than those obtained from the general population, as among such there would naturally be anxiety for issue—to preserve titles from extinction, or to keep landed estates in particular families. It is probable, too, that the personal feeling which occasionally exists on the part of the tenant for life against his successor, would tend to increase the probabilities of marriage; and, in reference to these points, it has been suggested to me, that the Peerage and Baronetage afford abundant materials from which satisfactory conclusions might be drawn. Many other interesting investigations might be undertaken from the collection of facts there contained, the results of which might be speedily rendered available by a few members of the Institute acting in combination.

The risk of fraud in these transactions, I am disposed to think, is generally exaggerated, assuming that reasonable inquiry is made when the insurance is granted. The only attempt which has come to my knowledge was in the case of a person who married a woman already pregnant, and fortunately this failed, the wife having miscarried.

Hitherto I have treated only of the question of single premiums. The annual premium, being payable during the life of the husband, should theoretically be derived from the single premium by the usual mode of dividing by $1 +$ the value of an annuity of £1 during his life; and if it were certain that the insurance would be kept up till the end of life, there could be no objection to this method; but as in contradistinction to ordinary insurances, the chief portion of the risk occurs in the earlier years, it cannot practically be adopted, since the policy would most probably be dropped when the risk was much diminished by increased age. It is, therefore, always desirable that these policies should be effected by a single payment.

In conclusion, I trust that although the foregoing observations may be considered crude, and the mode of approximation suggested not always practicable, I have nevertheless opened a new subject of discussion for the Institute, and have at least aided in removing any reproach which might be considered as attaching to the younger members of the Institute for contributing as yet but little to the literature of it.

On a Formula giving the Expectation of Life approximatively.
By CHARLES ARNOLD M. WILlich, *Actuary of the University Life Assurance Society.*

[Read before the Institute of Actuaries, 31st January, 1859, and ordered by the Council to be printed.]

DR. FARR, in the 12th Report of the Registrar-General, has given the value of annuities and the expectation of life, as deduced from the male English Life Table.

Observing a very uniform difference between the results thus obtained and those from the Carlisle Table of Mortality, it appeared to me probable that a simple hypothesis might be constructed which would produce a close approximation to the expectation of life between certain ages, but somewhat less favourable than the hypothesis* I proposed in 1857 for the expectation of life according to the Carlisle Table of Mortality.

On a further investigation, I have found that, between the ages of 5 and 60, the following hypothesis will give a very close approximation to the expectation of life as calculated by Dr. Farr:—

$$\text{Let } a = \text{the age, then } \frac{2(80-a)}{3} = \text{expectation;}$$

or, $\frac{2}{3}$ ds of the difference between the age and 80 = expectation.

Table showing the Expectation of Life, from the age of 5 to 60 years of age.

Age.	By Dr. Farr's English Life Table. Males.	By C. M. Willich's proposed Hypothesis.	Age.	By Dr. Farr's English Life Table. Males.	By C. M. Willich's proposed Hypothesis.
	Years.	Years.		Years.	Years.
5	50·21	50·00	18	41·35	41·33
6	49·89	49·33	19	40·67	40·66
7	49·39	48·66	20	39·99	40·00
8	48·81	48·00	21	39·31	39·33
9	48·16	47·33	22	38·63	38·66
10	47·47	46·66	23	37·96	38·00
11	46·73	46·00	24	37·28	37·33
12	45·95	45·33	25	36·60	36·66
13	45·17	44·66	26	35·92	36·00
14	44·38	44·00	27	35·24	35·33
15	43·62	43·33	28	34·57	34·66
16	42·84	42·66	29	33·89	34·00
17	42·08	42·00	30	33·21	33·33

* See *Journal of the Institute of Actuaries*, page 181 of vol. vii. Expectation of life from the age of 5 to 60—*Carlisle Table of Mortality*:—

“Let a = the age, then $\frac{2(81\frac{1}{2}-a)}{3}$ = expectation.”

Table showing the Expectation of Life (continued).

Age.	By Dr. Farr's English Life Table. Males.	By C. M. Willich's proposed Hypothesis.	Age.	By Dr. Farr's English Life Table. Males.	By C. M. Willich's proposed Hypothesis.
	Years.	Years.		Years.	Years.
31	32·53	32·66	46	22·48	22·66
32	31·85	32·00	47	21·82	22·00
33	31·17	31·33	48	21·17	21·33
34	30·50	30·66	49	20·52	20·66
35	29·82	30·00	50	19·87	20·00
36	29·15	29·33	51	19·22	19·33
37	28·47	28·66	52	18·58	18·66
38	27·80	28·00	53	17·94	18·00
39	27·13	27·33	54	17·30	17·33
40	26·46	26·66	55	16·66	16·66
41	25·79	26·00	56	16·02	16·00
42	25·12	25·33	57	15·39	15·33
43	24·46	24·66	58	14·77	14·66
44	23·79	24·00	59	14·13	14·00
45	23·13	23·33	60	13·60	13·33

A Chapter in Fire Insurance: "Specific" and "Average." By
THOMAS MILLER, of the Scottish Union Assurance Society.

[Read before the Institute of Actuaries, 28th February, 1859, and ordered by the Council to be printed.]

ACCORDING to present practice, when property is insured, both by average and by specific policies, the latter have to bear the whole of any loss which may occur, unless it exceed the total amounts which they insure; and, in that case, the excess of loss over the amounts they insure is covered by the average policies, and is subject to average at the settlement of the claim.

As it may be deemed advisable by the Offices, at some future period, to make average and specific policies bear proportionate shares of loss on property jointly insured by them, it is proposed to determine the rules by which their respective proportions may be ascertained.

All policies, whether specific or average, contain a condition to the effect that Offices insuring the same property shall be liable to make good rateable proportions of loss—that is, they are bound to bear shares of loss proportioned to the relative amounts insured; and the legislature has enacted, that a person's loss is the utmost amount he can legally recover under the insurance. With these

principles as guides, the solution of the question under consideration is not difficult.

If loss occur on property covered by a policy subject to average, the amount insured of the loss is found thus :—As the total value of the property insured is to the sum insured, so is the amount of loss which has occurred to the sum insured by the policy on the property destroyed. The last term, therefore, represents the whole amount insured at the time of the fire on the property which has been lost. It is a specific sum insured on the particular property destroyed, and applicable in the first place to the insurance of it alone. It is either greater, equal to, or less than the amount of loss, according as the total sum insured by the policy is greater, equal to, or less than the total value of the property covered. If it exceed the amount payable under the policy, the balance merges into the average insurance, and is liable to bear its share of any subsequent loss occurring during the currency of the policy.

Should loss occur on property insured by more than one average policy, and the condition be cancelled which gives a precedence to specific policies in the payment of a claim, then the Offices would require to bear shares of the loss in proportion to the respective sums insured on the property destroyed, which sums would be the specific amounts insured on that property, as found by the condition of average, in the manner shown above.

In conformity with the condition of rateable apportionment of loss, the rule of bringing the *whole sums insured* to bear upon *each* claim is imperative under specific policies, even when the limits of the insurances are not concurrent. Thus, if one policy insure stock alone at £1,000, and another stock and utensils at £1,000, and the loss be on stock only, each will bear one half its amount. The amounts insured by specific policies are, therefore, specific sums which cover first any loss which may occur, and if they exceed the amount of that loss, the balances are liable to bear their shares of subsequent loss occurring before expiry of the policies.

Specific insurances by average and by specific policies, are, therefore, intrinsically alike, and differ only in the laws by which their amounts are ascertained; but these amounts, when actually ascertained, would meet loss in precisely the same way; so that the natural share of loss to be borne rateably by average and specific policies jointly insuring the same property, would be found in the following way :—

RULE.—*Loss to be borne by policies, whether specific or average, in proportion to the respective specific sums insured on the property*

burnt; which specific sums, in the case of average policies, are the amounts of loss multiplied by the respective total sums which they insure, and divided by the total values of the property respectively covered by them; and which specific sums, in the case of the specific policies, are the respective sums insured by them.

For the sake of completeness, it may be noticed, that, were the specific insurances, whether by average or by specific policies, not concurrent in their limits, and should loss occur on more than the concurrent portions of the risks, then the specific sums insured would, for the purpose of settlement, be divisible into parts, proportional to the divisions of the loss. And further, should it be found, on trial, that loss would remain unsettled, while any of the specific *policies* insuring the property would be unexhausted by loss, then the relative proportions of the sub-divisions of the sums insured by specific *policies* would require to be re-adjusted, so that, by proportional deductions from those in excess, the deficiencies of the others might be supplied, and the obligation of specific *policies* to meet the whole loss, up to the sum insured, be made to harmonize with the condition of rateable payment of loss. The specific sums insured by the average policies would, however, be fixed unalterably by the condition of average, so that no change could be made in them.

The following is an apportionment of loss, illustrating the different operations which have been alluded to :—

There are three warehouses, A, B, and C—

Office P insures £3,000, average, on sugar, in A and B.

„ Q „ £1,250, ditto, on sugar and coffee, in B and C.

„ R „ £1,800, ditto, on sugar and coffee, in A, B, and C.

„ S „ £1,000, specific, on sugar, coffee, and spices, in B.

„ T „ £750, ditto, on sugar and spices, in B.

Loss in B.

On sugar, £2,000; coffee, £1,000; spices, £1,000.

At the time of the fire, merchandise to the values noted below was stored in these warehouses :—

	In A.	In B.	In C.
	£	£	£
Sugar	4,000	2,000	1,000
Coffee . . . . .	..	1,000	1,000
Spices . . . . .	..	1,000	1,000
	4,000	4,000	3,000

The specific sums insured by the average policies on the property burnt would, by the preceding rule, be found thus:—

$$P, \text{ on sugar, } £2,000 \times 3,000 \div 6,000 = £1,000;$$

that is to say, the loss on sugar *multiplied* by the sum insured by P, and the product *divided* by the total value of the sugar within the limit of P's insurance. In a similar way, the specific sums insured by the other average policies on the property burnt may be found, viz.:—

$$Q, \text{ on sugar, } £2,000 \times 1,250 \div 5,000 = £500.$$

$$\text{on coffee, } 1,000 \times 1,250 \div 5,000 = 250.$$

$$R, \text{ on sugar, } 2,000 \times 1,800 \div 9,000 = 400.$$

$$\text{on coffee, } 1,000 \times 1,800 \div 9,000 = 200.$$

The limits of the specific policies not being concurrent, the sums which they insure require to be divided into partial specific amounts, proportional to the divisions of the loss. Whence, in the case of S, we find a policy insuring sugar, coffee, and spices, the total loss on which is £4,000, so that we have this proportion:—

Total Loss.	Loss on	Sum insured by S.	The proportional divisions of sum insured by S.
£4,000	: Sugar £2,000	:: £1,000	: £500 on sugar.
4,000	: Coffee 1,000	:: 1,000	: 250 on coffee.
4,000	: Spices 1,000	:: 1,000	: 250 on spices.

By a similar process of calculation, the proportional divisions of sum insured by T, appear to be—

£500 on sugar; £250 on spices.

By arranging the particulars which have been found in a tabular form, we are enabled, at a glance, to see the results:—

	PROPORTIONAL AMOUNTS INSURED SPECIFICALLY BY						Loss.	
	Average Policies.			Specific Policies.				
	P.	Q.	R.	S.	T.			
Sugar	1,000	500	400	500	500	=£2,900	£2,000	Excess, £900.
Coffee	..	250	200	250	..	= 700	1,000	Deficiency, £300.
Spices	..	..	..	250	250	= 500	1,000	Deficiency, £500.

This arrangement would leave loss on coffee and spices unsettled, while the specific policies of S and T, insuring these articles, would be unexhausted by the loss. Hence, in accordance with the rules of specific policies, the deficiencies must be supplied

by proportionate contributions from the amounts in excess. As P, Q, and R insure together £1,900 on sugar, the amount which *must* be got from S and T, to make up the loss of £2,000, is only £100—so that their joint excess on sugar is £900. As each of these last insures £500 on the sugar, its individual share of the £100 is £50, leaving £450 as the sum which each *has to spare* to meet the deficiencies of the other items. T has to contribute its share of a deficiency of £500 on spices; S its share of a deficiency of £800—£500 on spices and £300 on coffee—so that the amounts which the latter has to spare to meet the deficiencies on these separately, are found thus:—

					Sum applicable to diminish deficiency.	
£800	:	£300	::	£450	:	£168·75 on coffee.
800	:	500	::	450	:	281·25 on spices.

But the £281·25 on spices has only to contribute a *proportion* of the deficiency of £500 on that item, along with T's £450. Wherefore £281·25 + £450 =

£731·25	:	£281·25	::	£500	:	£192·3	= amount required from the
							excess of S to make up
							the deficiency on spices.
731·25	:	450·	::	500	:	307·7	= do., do., from T's excess.
						<hr/> 500·0	

In viewing these results, it appears that of T's excess of £450, a sum of £307·7 is required to make up the deficiency of its proportional sum insured on spices, and the difference between the two amounts being £142·3, is free to bear its proportion of the loss on sugar, along with the £50 which had been left as its proportional amount insured thereon. This will make its divisional sums to be—on sugar, £192·3, and on spices, £250 + £307·7 = £557·7; together, £750, as in the policy.

With regard to the sum of £168·75, which has been assigned as S's proportion of the £450 in excess, applicable to diminish the deficiency on coffee, it appears that it still leaves a deficiency on that item of £131·25, while the policy would yet be unexhausted. As, by the obligation of specific policies, loss must be paid as far as the amount insured, that policy is bound to make good such deficiency on coffee so far as it can.

The amount insured on sugar, by P, Q, and R, being £1,900, and by T, as already seen, after providing for the loss on spices, £192·3—together, £2,092·3—the loss of £2,000 on that article is fully provided for, even without any contribution from S; there-

fore, the policy of the latter is thus enabled to make up the whole deficiency on coffee, and its divisional amounts will be—on sugar, £7·7; on coffee, £550; and on spices, as already found, £250 + 192·3 = £442·3—together, £1,000, the total amount which it insures.

We are now enabled to give the following as the exact apportionment of the loss, each of the policies bearing proportionate shares:—

	SPECIFIC SUMS.					Loss.	TO BE PAID BY					TOTALS.
	Average Policies.			Specific Policies.			P.	Q.	R.	S.	T.	
	P.	Q.	R.	S.	T.							
Sugar	1,000	500	400	7·7	192·3	2,000	952·4	476·2	380·9	7·3	183·2	2,000
Coffee	..	250	200	550·0	..	1,000	..	250·0	200·	550·0	..	1,000
Spices	..	..	..	442·3	557·7	1,000	..	..	..	442·3	557·7	1,000
	1,000	750	600	1000·	750·	4,000	952·4	726·2	580·9	999·6	740·9	4,000

The preceding example of adjustment, which is as complex as any likely to occur in practice, has been selected for the purpose of illustrating the various topics which have been introduced into this paper,—viz., the fact that specific sums are insured by average policies, and how these sums may be found; the plan of subdividing the amounts insured by specific policies, and the method of reducing the deficiencies of any such subdivisions by proportionate contributions from those in excess, so that the rule of proportional payment of loss may harmonize with the obligation of specific policies to pay loss as far as the sums insured; the practicability of making average and specific policies bear together rateable proportions of any loss which may occur on property jointly insured by them; and the natural rules for fixing these proportions as deduced from the principles of average and specific insurance.

It would be well to bear in mind that the assured has no right, in any case, to *select* the Office upon which he can make his claim, as, by the conditions of the policies, no Office is bound to pay more than a rateable proportion of the loss. Neither has one Office a title to object to a subdivision of the sums insured by another when such subdivision is made in conformity with the conditions of the others' policy, as each policy is dependent for what it insures upon its own terms and conditions. But it is

the loss which arbitrates between different Offices; and each policy, subject to its own conditions, has to be placed into the position which will enable it, in due proportion with the others, to discharge its obligations *with best effect to the loss*.

Had there not been some forgetfulness of first principles in the apportionment of claims, it may be surmised that the additions would not have been wanted which have been made from time to time to the average clause. It is a mistake to divide loss in proportion to *liabilities*, as the conditions provide that the division is to be made "*according to the several sums insured;*"* and when policies are concurrent in their terms and limits, this rule has *invariably* been respected, so that there can be no doubt whatever as to the interpretation which should be given to it. If that interpretation be correct, then it is only in proportion to *sums insured* that loss should be borne. The *independent liabilities* of the new average policies are really the *specific sums they insure*, and the name they have received has been given them under the mistaken idea that they are *necessarily* the amounts for which the Offices are *liable*. Fire insurance *liability* has had many different meanings affixed to it. In some instances it has been supposed to be *the sum insured*; in others, *the sum insured increased by any required amount*; in others, *the sum insured repeated several times*; or, *the whole amount of loss as far as the sum insured*;—but none of these interpretations are correct, as the policies give the true meaning; and they state that it is merely *an obligation* under which the Offices come to pay the whole or some proportion of loss, should one occur.

On the Settlement of Losses by Fire under Specific and Average Policies, Separate and Combined. By DAVID CHRISTIE, Esq., of the Sun Fire Office.

[Read before the Institute of Actuaries, 28th March, 1859, and ordered by the Council to be printed.]

A NOTE of alarm has been sounded at the present mode of adjusting fire losses under average policies; and it will be well, though for other reasons, hereafter to be explained, than those to which it owes its origin, that it be not allowed to die away without some effort to gain additional vantage-ground towards the substitution of a comprehensive and reasonable scheme

* *Vide* Conditions of the "Royal Exchange" and the "Union."

of apportionment for the mischievous and unsound practice which now exists.

The different systems in operation are so unnecessarily complicated, and the machinery by which each is set in motion so rude and unconnected, that the wonder is, not that any attempt at improvement has given rise to a word of warning, but rather that the cumbersome construction should have lasted so long.

True, there have been murmurings at times from those who have been forced to give an attentive ear to the discordant jarring of its parts; but the sign of dissatisfaction has passed away with its cause, like the reverberations of an echo. There is a feeling, indeed, of a balance of results being attached to the old rule, which may have given zest to its perpetuation.

It has been said that no better reason can be assigned in support of the present practice, than that an Office expects to recover by it at one time what it loses at another. This reliance on the caprice of fortune indicates how little the principles of average are understood, and how strongly attached the Offices must be to a system in itself eminently defective, when so little sign of effort has been evinced to replace it by a more intelligible rule.

It must be apparent, to those who have given attention to the subject, that there is some necessary proportionate connexion between all policies, however diverse in their nature, covering a certain property; and this connexion is not confined to specific with specific, or average with average policies, but affects either or both in any combination. The difficulty has been to establish the relation which one policy bears to another, and it may safely be assumed that, until a solution shall be found true to every test, in whatever form it may be applied, there can be no sound basis to regulate the proportion to be borne by each Office in case of loss under mixed forms of policies.

But, before considering the subject more minutely, let us see whether some preliminary simplification cannot be adopted. This leads us to the question how the Offices stand with the public. At present, policies are, in general, issued as they are desired by the assured, without due regard to the probability of other insurances on the same property existing in other Offices, and hence arise the different ranges frequently complained of;—one being, for example, on stock alone; another, on stock and utensils; and another, on stock, utensils, and fixtures, in one undivided sum.

In average policies we have the same want of harmony—insur-

ances in docks, in docks and warehouses, &c., &c.; and still more extensively, within five or six miles of the Royal Exchange.

That such a practice still exists, is in itself sufficient evidence that no extraordinary effort has been made by the Offices to establish a rule for enforcing policies of concurrent ranges; and, until this is done, the settlement of losses under these varied forms will remain a vexed question, both with the Offices and their surveyors, as well as a cause of needless delay in the payment of claims to the assured.

It is indeed fortunate, however little they may be aware of it, that the public are interested in any improvement that may take place in the forms on which policies are issued, and also in understanding the principles on which losses should be settled.

It is proper that this should be borne in mind, because much of the present system of settlement is chargeable with the ignorance they are supposed to have on these matters, though, strictly speaking, the fault rests with the Offices in perpetuating rules which the public cannot reasonably be expected to understand. Hence, when any difficulty arises, the Offices liberally assume (which, indeed, is an evidence of the weakness of their position) that the blame, which in many instances rests with the assured, of not having his policies concurrent, should not prove a source of loss to him for want of not knowing better.

It is, however, a question of greater importance than the apathy of the Offices would seem to evince, that a better principle should obtain for procuring uniformity of range on fire policies.

It is said, in favour of the present system of settlement, that an Office insuring one item in a specification—such as stock—exhibits a greater degree of prudence than another having more than one item—such as stock and utensils, or stock, utensils and fixtures—and ought, in any adjustment, to reap a corresponding benefit. This is mere fancy. As has been already stated, insurances, in the generality of cases, are taken as they come; and the fact of having one, two, or three specifications, is simply a record of the wish of the assured.

Indeed, might it not be justly argued on the contrary, as has been the custom hitherto with certain average policies, that a policy on a single item is more responsible on that item than another policy spreading over a larger range? Besides, the views of the Offices, as to settlements under specific insurances of different ranges, have lately been materially modified, and exhibit marks of progress towards sounder principles.

It is only a few years ago since an Office was called upon to pay the amount of loss (not exceeding the sum insured) on items not mentioned in the specification of another policy, as well as its share of the loss on the item insured by both policies, in the proportion of its *total* liability. But it is now considered more reasonable that the loss on the former should be first ascertained, and deducted from the amount of the policy, before adjusting the proportion to be paid on the item to which both policies extend.

When average policies were involved (so to speak), there were no end of anomalies. Specific policies, then as now, for want of a better system, were called upon to pay first; then, average policies of more limited range than others; then, concurrent average policies with each other; until the great fire at Liverpool, in 1842, caused a change in part, and, so far as that port was concerned, a sounder application of the average principle, though yet defective, was adopted.

Strange to say, the anomaly of one system prevailing only at Liverpool, and another at all other ports and places in the kingdom, was perpetuated until the late fires in the docks, &c., in London, when the latter city was brought within the scope of the rule. How long it will be until the practice becomes universal, it is difficult to predict; but the sooner the Offices determine this point, the easier will it be to settle a loss when it occurs.

To those who have well considered the "independent liability clause," no explanation will be necessary to show the wisdom of it.

But, in spite of Mr. Atkins' observations, which are very clear and forcible, Mr. Ray comes forward, inconsiderately, to do battle in the cause of repeal. He appears not to be aware of the practice which has obtained in Liverpool these last sixteen years, and that "the hasty alteration of the common average clause" is simply an extension of the Liverpool practice to London.

Mr. Ray suggests that a clause should be added to the existing conditions, to make average policies of a "*lesser* range," in certain circumstances, specific; which would, in fact, be undoing what has been done, and, at the same time, making a thing what it is not.

There is no necessity for assuming that, unless this is adopted, the assured will be placed in a false position with the Offices. It is the duty of the Offices to place them in a true one, and for the assured to adhere to the regulations which must be enforced. The plan is simple, and easy of adoption, and without it no sound basis can be given to the principles of average.

The necessity for policies being concurrent has already been

dwelt upon. It will be useful to repeat the suggestion here, because in their not being so lies the head and front of the offence. Why an Office should issue, as a matter of course, a policy on docks, and another a policy on docks, wharves, &c., &c., for the same party, is not easy to determine. It would be no hardship to require the assured to have all his policies on docks alike, or, as may be, on docks, wharves, &c., and so keep the average principle undisturbed; for, the moment this is disregarded, the settlement of a loss becomes a mere matter of theory and opinion.

Take, for instance, the example quoted by Mr. Ray, as "placing the assured in a false position with the Offices":—

Insurances.	Property.
Office A, £5,000 docks	£5,000 docks.
,, G, 5,000 docks and wharves	5,000 wharves.
Loss, £5,000 wharves.	

It is proposed to ignore, because a loss occurs on the latter, the policy in A and the property in the docks; but, even in this extreme case, is it right, for the purposes of settlement, to cancel these two items as if they were meaningless, when another policy on docks, with property in docks where *part of its risk lies*, is no unimportant feature in the case? This would be repudiating the latter policy's interest in the property in the docks; but if a loss were to occur at the same time in the docks, the settlement would be materially altered; and by this fire on property in which it has its share of risk, it would be made to pay less than if the loss were confined to wharves.

Suppose the policy in docks and wharves to be taken out first, with the property as already represented, is it not a monstrous perversion of anything like principle to say that, by another Office issuing a policy on docks—part of the risk already covered and now shared in—the former policy has a heavier liability?

There is a proportion between these two policies and the property they cover, which ought to be determinable; and it is from the mere fact of their being issued without concert that the difficulty arises.

The case is worth illustrating further, for the sake of the proof afforded.

Take a total loss on the docks: the liabilities of the two policies would be—A, 5,000; G, £2,500; clearly representing a surplus of insurance on the property; and if this example be true, a total loss at the wharves will exhibit a deficiency of insurance equal to the surplus above stated; thus, A is excluded because it

does not extend to wharves; G only insures half the amount of property within its range, and is therefore only liable for half the loss, £2,500. Nothing could be clearer, and the remedy is simply to have both policies in unison.

But let us go a little further. Take the example in the “Liverpool” circular, as it may be termed—

Insurances.	Property.
A, £10,000 in warehouses . . .	£15,000 in warehouses.
B, 10,000 in warehouses and ships .	5,000 in ships.

Here, £20,000 is insured on £20,000 worth of property; but the wording of the policies is not concurrent, and the distribution is again unequal—an excess being insured in warehouses. In case of loss on ships, who shall say, *supposing* Mr. Ray’s view to be right, what sum should be deducted for A’s risk in warehouses *where no loss has happened*? No doubt Mr. Ray will say £10,000; but this is equal to the total amount of the policy, while the property is valued at one-third more; and consequently, whether the property in warehouses be £10,000 or £20,000, it would not, according to Mr. Ray’s idea, alter the amount to be deducted. This is setting at defiance all principles of proportion.

If it were possible to rescind the late resolutions, and a heavy fire were to occur, we should have the old question of ranges revived—which is the greater and which the less. The late Mr. Richter made a happy hit when he hinted, that if the Offices were to go a-tilt in this manner and embrace what was not intended, simply to exhibit greater range without the risk of it, he would quietly include a church!—a device which few would think of in common with the worldly affairs of insurance, until the loss, and the degree of immunity from liability which the wording conferred, revealed it to their wondering eyes. Thus a way would again be opened up to an unscrupulous Office to set at nought the morality, so to speak, of insurance practice, whereas, under the “independent liability clause,” no apprehensions need be raised, and the church would be left sacred to itself.

It is therefore to be desired, that the average principle, in its true meaning, may be extended to all average policies; and, if this be done, there will be no difficulty in making the assured acquainted with its provisions and application. At present he enjoys shelter under sufferance, because the custom of the Offices as to ranges, &c., is inexplicable to common sense, and he is considered not bound to know the sinuosities of an absurd system, which has

no strict relation to figures (though it mainly deals with them), and cannot be explained by them.

Let us, then, hail with satisfaction the wider application of the Liverpool system, and hope for its early extension to all parts of the kingdom. Indeed, if the principle be sound, there is no reason for retaining the old rule, in any part of the kingdom, a day longer. Let it be expunged, and, if possible, forgotten.

But the principle will not be fully developed until the Offices are ripe for sanctioning an alteration in the present application of specific policies, when combined with those under average; and, with the view of bringing the matter under consideration, it will be proper here to notice the existing practice and suggest a remedy.

The subject is one of vast importance, and, therefore, if the prevailing system be founded in error, and a substitute can be proposed that shall stand the test of every variety of application, the sooner such system is abrogated the better.

There seems something incomprehensible in two policies covering, in a computable proportion, the same risk, one of which must stand the brunt of the loss until its amount be exhausted before the other comes into operation for any fraction of its responsibility; and, surely, it is worthy the best efforts of all connected with insurance business to endeavour to establish a more equitable system—one more in unison with a correct appreciation of sound doctrine.

Mr. Atkins has attempted to solve the difficulty by a proposition to the effect that the actual amount of loss, if not exceeding the sum insured, should represent the liability of a specific policy,* in cases where the property is covered both by specific and average policies.

This proposal is made with a degree of earnestness that leaves no doubt of its having been previously well considered.

The following is an example :—

					Value of Property.
Average policy	.	£5,000	.	.	£10,000
Specific policy	.	4,000			
		Loss, £2,000.			
The liability of the average policy will be half the loss	.	£1,000			
„ „ specific policy, the amount of loss	.	2,000			
					£3,000

But as the actual loss is only £2,000, the proportions payable under each policy will be—

* See *Assurance Magazine*, page 3 of this Volume.

Average policy	.	.	.	.	£666 $\frac{2}{3}$
Specific „	.	.	.	.	1,333 $\frac{1}{3}$
					<hr/>
					£2,000

But Mr. Atkins has evidently confined his proof to cases of this simple character. Had he taken an ampler field of application, he would have discovered an insuperable objection to the adoption of his proposal. Let an example suffice:—

Suppose that, in lieu of one specific policy of £4,000, there are two of £2,000 each. The operation will then be—

The liability of average policy = half the loss	.	.	£1,000
„ specific policy A, the amount of loss	.	.	2,000
„ specific policy B,	„	.	2,000
			<hr/>
			£5,000

which, reduced in relative proportions, will be—

Average policy	.	.	.	.	£400
Specific policy A	.	.	.	.	800
„ B	.	.	.	.	800
					<hr/>
					£2,000

Here, then, the proof has fled, the result being widely different; and shall it be said, under this rule, that a specific policy of £5,000, and another of £10,000, must, under losses not exceeding the smaller policy, be responsible for identical amounts, with liabilities so widely different?

In all cases of true apportionment there must be harmony in the result, otherwise there can be no fixed principle to govern us in arriving at a correct adjustment. But the liability of a specific policy, in conjunction with an average policy, will be found to be, not in the amount of loss, which has been proved to be erroneous, but in the actual amount which it covers.

An example or two may be given in illustration:—

EXAMPLE I.

		Value of Property.
Average policy, £5,000, in warehouse A	.	£10,000
Specific ditto, 3,000, in ditto.	.	
Loss, £6,000.		

The liability of the average policy is half the loss, viz.	£3,000
„ „ specific policy is its full amount	3,000
	<hr/>
£6,000	

EXAMPLE II.

	Value of Property.
Average policy X, £5,000 in warehouse A . . .	£10,000 in A.
„ Y, 5,000 in warehouses A and B. . .	10,000 in B.
Specific policy . 5,000 in warehouse A.	
Loss in A, £4,000.	
The liability of X is half the loss, viz. . . .	£2,000
„ Y is one fourth the loss	1,000
„ specific policy is its total amount . . .	5,000
	<hr/>
	£8,000

which, being exactly double the actual loss, the proportions of each will be one half, viz.:—

X	£1,000
Y	500
Specific	2,500
	<hr/>
	£4,000

EXAMPLE III.

	Value of Property.
Average policy, £20,000 in warehouse A . . .	£40,000
Specific policy X, 5,000 in ditto.	
„ Y, 10,000 in ditto.	
Loss, £20,000.	
The liability of average policy will be half the loss	£10,000
„ specific policy X, its full amount . . .	5,000
„ „ Y, „	10,000
	<hr/>
	£25,000

which, as it exceeds the loss, must be reduced as follows:—

As £25,000 : £20,000 :: £10,000 : £8,000, loss under average policy.	
„ 25,000 : 20,000 :: 5,000 : 4,000, „ specific pol. X.	
And „ 25,000 : 20,000 :: 10,000 : 8,000, „ „ Y.	
	<hr/>
	£20,000

In general terms, an average policy must, in the adjustment of losses either with other average policies or with specific policies combined, be taken in its exact proportion in regard to the total value of the property, whether it is under or *exceeds* said value, and a specific policy must always be taken at its total amount as representing its liability.

An example may be given to prove the former statement, as regards average policies exceeding the value of the property.

	Value of Property.
Average policy X, £20,000, in warehouse A . .	£10,000.
„ Y, 10,000, „	
Loss, £6,000.	

The liability of X will be <i>double</i> the loss, viz.	£12,000
„ Y will be equal to the loss, „	6,000
	<hr/>
	£18,000

which, as it exceeds the actual loss, must be reduced as follows:—

As £18,000 : £6,000 :: £12,000 : £4,000, loss under X.
„ 18,000 : 6,000 :: 6,000 : 2,000, „ Y.

This may be illustrated by dividing the policy X into two policies of half the amount, viz.:—

Average policy X, £10,000 in A	Value of Property.
„ X ^a , 10,000 „	£10,000
„ Y, 10,000 „	
Loss, £6,000.	
The liability of X will be equal to the loss, viz.	£6,000
„ X ^a „ „	6,000
„ Y „ „	6,000
	<hr/>
	£18,000

which, being reduced, gives £2,000 each,

or, £4,000 for X and X ^a combined.
and 2,000 for Y.
<hr/>
£6,000

It may appear strange that the specific policy should be brought into the adjustment for its total amount, but in all cases of apportionment of specific with average policies, that alone is the correct principle; and it will be found to be so, not only in working out the question in all its bearings, but, perhaps, more simply in the fact that losses under specific policies are always adjusted in the proportion of their respective totals. For example:—

Three specific policies, X, Y, and Z, of £5,000 each; loss, £9,000.

The liability of X will be	£5,000
„ Y „	5,000
„ Z „	5,000
	<hr/>
	£15,000

But as the actual loss is only £9,000, the proportions will be—

As £15,000 : £9,000 :: £5,000 : £3,000, loss under each.

The peculiarity lies in the extraordinary nature of a specific policy. It represents a certain sum on certain property, but has no proportionate relation, as an average policy has, to that property, and is, in fact, an anomaly altogether. Thus, if it insures £1,000

on household goods, valued at £2,000, it does not represent any strict proportion of this £2,000, but a *bond fide* liability to the extent of the sum it covers. No piece of furniture is insured for half its value; and, in fact, in the case assumed, the articles insured are not positively known to be insured until a fire happens.

An average policy exhibits the true principle of insurance.

An Account of the Plan, Objects, and Progress of the International Association for obtaining a Uniform Decimal System of Measures, Weights, and Coins. By SAMUEL BROWN, F.R.G.S., F.S.S.

[Read at the Meeting of the National Association for the Promotion of Social Science, held at Liverpool, 1858.]

THE Great Exhibition of 1851, however fruitful it was in direct results beneficial to the trade and commerce of this country, has indirectly produced greater consequences still, by leading to the discussion of questions in which the common interests of all the nations of Europe are concerned.

Scientific and enlightened men from all countries were enabled to consult together on many topics which had hitherto been considered as the imaginary schemes of isolated individuals, and which, though conducive to the best interests of humanity and the progress of civilisation, failed for want of co-operation and the means of communicating with kindred minds in other countries. The various congresses which have been held in Brussels, Paris, and Vienna, for statistical, scientific, or benevolent objects, nearly all trace their origin to that wonderful Exhibition, which gave as great a stimulus to the intellectual progress as it did to the commercial intercourse of all nations.

From the vast variety of products collected from all the regions of the earth, in which both values and quantities were reckoned by all sorts of different standards, the want of some uniform system of estimation and measurement soon became strikingly apparent. What had been hitherto considered by some men as a mere philosophical dream was here a commercial necessity. To compare the products of different countries together, the merchant or manufacturer was obliged to reduce the complicated monetary values, or the weights and measures of so many different countries, to the system of his own. It may be safely said, that a very large part of the advantages to be derived from the Exhibition was lost to

thousands, who, though qualified by experience to understand the skill and labour expended in the productions of foreign countries, were not accustomed to the task of translating foreign monies or of reducing foreign weights and measures to our own. So strongly was this felt, that, at the close of the Exhibition, the Society of Arts, which had been instrumental mainly in forming this magnificent collection of the world's industry, presented a memorial to the Lords Commissioners of Her Majesty's Treasury, expressing the satisfaction with which the Memorialists had heard that Her Majesty's Government had under their consideration the question of introducing into this country a system of decimal coins, weights, and measures, and urging how important such a step would be in advancing the arts, manufactures, and commerce of the country. They pointed out how the growing intelligence and education of every people are sweeping away those feelings of personal antipathy which formerly existed, and how much this beneficent result would be increased by facilitating international relations; that a uniformity in measures, weights, and coins, would be of the utmost importance to commerce, and, in measures and weights especially, would greatly facilitate scientific research. They submitted it, as a matter of grave consideration, whether, in introducing a change to a decimal system of coins, weights, and measures, some arrangements might not be made with neighbouring nations for the adoption of a uniform system throughout the world; that, sooner or later, such a system would be loudly called for by different nations, and the inconvenience of a second change might be obviated by a little judicious forethought; that it was worthy of this country, that had inaugurated "unrestricted commerce, unrestricted navigation, and which invites, by its exhibitions and by its policy, the most unrestricted competition," to make the first advances towards such a glorious act; and that there was nothing impossible in the idea, since several nations on the continent of Europe have already the same coinage, and the metrical system of weights and measures is still more widely adopted. This memorial was highly creditable to the Society which had taken so active a part in that great undertaking, and which could not but be aware, by experience, both of the necessity and advantage of the change proposed. In the Exhibition itself the subject had not been overlooked. James Yates, Esq., F.R.S., to whose unwearied advocacy and talented writings it is owing that the cause has within the last few years made so great a progress in this country, had drawn the attention of M. Peut, the able editor of *La Patrie* (who, at the Peace Congress held at

Paris in 1849, had made an eloquent address on the propriety of aiming at the uniformity of weights, measures, coinage, and postal duties, as one of the most efficient means of carrying out the objects of that congress), to the good opportunity afforded by the Great Exhibition of making known the metrical system more fully in this country. His appeal, made public by M. Peut, in *La Patrie*, was responded to by individual exhibitors and by the Government of France, and complete sets of the measures, weights, and coins of the metrical system were exhibited in the Crystal Palace. One set was purchased by Henry Johnston, Esq., and presented to the Society of Arts, in whose museum it now remains. The Academy of Science and Arts at Mâcon, and the Chamber of Commerce of the Department of Saône and Loire, sent M. de Vinsac and M. Carteron, President of the Academy, to press upon the leading members of the Juries of the Great Exhibition the vast importance of a uniform system of measures, weights, and coins, and especially the advantages to commerce and science if the metrical system were generally introduced. Though unsuccessful in their direct object with the British Government, there can be no doubt that these gentlemen excited the attention of many influential and commercial men to the subject, and sowed the seeds of future good.

The interest of this question, thus excited, was not allowed to drop. In 1853, a Statistical Congress was held at Brussels, at which the representatives of the principal Governments of Europe, and a very large number of scientific and practical men, were assembled. The importance of a uniform system of measures, weights, and coins, could not but force itself on the attention of men who, in studying the comparative statistics of foreign countries, would find their labour vastly increased by the incongruous weights, measures, and values, in which commercial products or the general statistics of different countries are expressed. As the subject was not one for discussion in the original programme, no general uniform system was decided on; but a recommendation was agreed to, that in the statistical tables of countries not possessing the metrical system, a column should be added indicating the metrical reduction of weights and measures.

Two years afterwards, viz., in 1855, the second meeting of the Statistical Congress was held in Paris, and as the "Paris Exhibition of the Manufacturing Industry of all Nations" took place in the same year, advantage was taken of this doubly-favourable opportunity again to bring this subject prominently forward; and as the

result was the establishment of the Society whose plan, objects, and progress I have now briefly to lay before this meeting, the steps taken may be explained a little more in detail.

A circular, dated 30th August, 1855, signed by seven members of the House of Commons, and six other gentlemen, was sent out, principally to the commissioners or jurymen of the Paris Universal Exhibition, or to the members of the Statistical Congress, then assembled at Paris, with the view of eliciting information on the various systems of coins, weights, and measures prevalent in different countries, and their relation to the English system, and on the best means of obtaining a uniform international system for all countries, and of ascertaining the views of the parties addressed as to the difficulties to be surmounted in effecting this end. The circular was sent out by Mr. Yates; and the answers returned—coming from such high authorities, and concurring, as they do, almost entirely in the practicability and desirableness of a uniform decimal system for all nations—will be read with the greatest interest. They will be found in the Appendix to Mr. Yates' *Narrative of the Origin and Formation of the Association*, now alluded to, which was published in 1856. Lord Monteagle, in his reply, suggested that in the questions addressed to the natives of countries where such changes had already been effected, they should be requested to give a statement of any inconveniences resulting from the first alteration, and the precautions taken either to avert or to lessen such inconveniences; and, where possible, to obtain copies of the laws and ordinances promulgated to give effect to the change—valuable suggestions not neglected by Mr. Yates. Other replies contained the history of the metrical system and its introduction into various countries, together with the opinions of the writers on the advantages of a uniform system, and the means of surmounting the difficulties of its introduction in any country. They formed a valuable collection of practical suggestions, and gave great encouragement to proceed to active measures.

A few days after the issuing of this circular, viz., on the 10th of September, 1855, a discussion took place on the circular letter at the Society of Political Economists in Paris, at which Mr. Yates ably introduced the subject, and representatives from several countries in Europe carried on a very animated and interesting debate. Amongst the speakers were M. Vattermarre, M. Visschers of Brussels, Mr. Sumner of the United States, M. Berg of Stockholm, M. Cogels of Antwerp, and MM. Garnier, Peut, and Horace Say, of Paris; and the general conclusion was, amongst these eminent and

well-known writers, that the uniformity suggested was not merely desirable in theory, but proved by experience to be feasible in practice.

In the Statistical Congress itself, an important resolution was proposed by M. Hippolyte Peut, and carried, after a debate in which many of the great political economists or government officials present took part. It was ably supported, amongst others, by the Vice-President of the Congress, Baron Charles Dupin, formerly Minister of Agriculture, Commerce, and Public Works, whose elaborate writings are so well-known. M. Peut's resolution was to the effect that the Congress, considering how much the adoption by the different nations of a uniform system of measures, weights, and coins, would facilitate the comparative study of the statistics of different countries, resolves, "that it is desirable to put such a uniform system into energetic practice."

The members of the International Jury of the Universal Exhibition in Paris, or commissioners sent by their respective Governments to this Exhibition, had likewise made a declaration of their deliberate opinion, that one of the methods best adapted to accelerate that happy movement, which brings all nations together in the paths of their industry, would be the adoption of a universal system of weights and measures; that, if this uniform system were decimal, a large portion of valuable time would be saved to all persons engaged in industrial or commercial pursuits; that the saving of time would be still greater, if the different units denoting length, surface, bulk, weight, and money, were deducible from each other, according to decimal relations between their elementary constituents; and that the names by which the units were distinguished in different countries would be of no importance, since, in the greater number of cases, the old names would be retained, without difficulty, for the new units.

Other steps, which had been taken recently in different countries, showing the growing interest with which this important question was regarded—such as the petition to Congress of citizens of the United States residing in Paris; the memorial to Congress from the American Geographical and Statistical Society; the introduction into the Zollverein of Germany of a weight exactly equal to 50 kilogrammes of France; the metrical system established by law in Frankfort; the interchangeable monetary system of the smaller States of Germany, though the coins might issue from different mints; and the strong expression, in favour of metrical coinage, of the delegates assembled at Vienna to devise a monetary system for all Germany; not to mention the discussion going on on the

necessity of some simplification, on the decimal basis, of the weights, measures and coins, in this country—all combined to encourage the formation of an Association which would unite in one purpose the enlightened men who, in different countries of Europe and America, were striving with isolated efforts, and would give to their exertions unity and strength. Accordingly, at the close of the Statistical Congress, two private meetings were held, preliminary to a full and important assembly on the 24th September, 1855, at which the commissioners of the different countries, and the members of the several juries connected with the Great Exhibition, were invited to attend. It might be invidious to mention English names, when men of all countries concurred so heartily in the work; about 150 persons, representatives of the Governments, the science, the commerce, or the intellectual progress, of the greater part of Europe and America, were present. Baron James de Rothschild, the head of the greatest European banking house, presided, and his address on the occasion pithily and eloquently summed up the advantages of the system proposed.

After this address, resolutions, read by M. Peut, were debated, and, after some discussion, unanimously passed. They referred to the resolution of the International Statistical Congress, in 1853; of the Statistical Congress, at Paris, just held in 1855; to the address, signed by the members of the International Jury, and by the commissioners of the various Governments, at the Universal Exhibition, at Paris; to the memorial to the Congress of the United States, presented by the American Geographical and Statistical Society; and to the efforts made by several great States, especially by the Zollverein of Germany, to arrive at a uniform system of money, weights, and measures; and it was determined, thereupon, to establish an International Association, composed of members, chosen from the different civilised nations, who should engage to devote themselves—each in his own country, by means of committees appointed for this purpose, and corresponding with one another—to the establishment, in all civilised countries, of a uniform decimal system of weights and measures, and, as far as possible, of monies. The second resolution merely provided that all discussion, beside the special object of the Association, should be interdicted—no doubt intended for the purpose of disabusing foreign Governments of the idea that the Association might be perverted to any political objects. The members present signed their names, classed under their respective countries; and a vice-president was appointed for each country. The nucleus of the branch committees was thus formed.

Two subsequent meetings were held, on the 16th October and 17th November, at which the plan of the Association was matured. It consisted of

1. The central society, called the International Association, for obtaining a uniform decimal system of measures, weights, and coins. Its direction comprised a president, vice-presidents, nominated from different countries; a central committee, consisting, as far as possible, of two members of each country; and secretaries for England, France, and the United States.
2. Branch societies, consisting of vice-presidents, committee, and members.

The French branch society, and the branch society for Great Britain and Ireland, were formed on the spot. The names of the vice-presidents, and of the members who gave in their adherence, comprise many of the most distinguished for their efforts in the cause of education and social progress in both countries. In proof of this assertion, it will be sufficient to point out amongst the vice-presidents or members of the British Society, the Archbishop of Dublin, the Earl of Shaftesbury, and Viscount Ebrington, who took a most active and influential part in the preliminary meetings, Mr. J. B. Smith, M.P., Mr. James Yates, F.R.S., Mr. Babbage, Mr. Chadwick, Mr. Henry Cole, Mr. Fairbairn, Dr. Farr, Sir Charles Fox, Dr. Hodgkin, Professors Key, Leoni Levi, Marks, Owen, &c. Considering the very different aspects in which the question might be viewed in different countries, and the various constitutions on which branch societies might be formed, it was wisely resolved to hamper them as little as possible with fixed rules or regulations. It was considered to be the most judicious course to leave to the committees, appointed by the members, the task of recommending the laws and regulations by which the branch society could most effectually accomplish the end in view, and attract the notice of the public. A few suggestions were offered for consideration, so that all might work with unity and effect in promoting the common cause; and these, in fact, constitute the objects which each branch was to pursue, at the times and in the manner which might be deemed most advantageous. Thus, the invidious feeling of foreign dictation was avoided, and it seemed probable that both harmony and strength would be given to the operations of the central Association.

(To be continued.)

FOREIGN INTELLIGENCE.

GERMANY.—*Life Assurance Business in 1857*.—We have been favoured with the following Tables by Herr Finanz Rath G. Hopf, Correspondent of the Institute at Gotha.

TABLE I.—*New Business and Position of the Life Assurance Companies of Germany in the Year 1857.*

Established.	Name of Company.	Assurances existing at the beginning of the Year.		New Assurances during the Year.		Assurances existing at the end of the Year.		Income (Premiums and Interest).	Claims paid.		Expenses of Management.			Assurance Fund.				Average Dividend during the last ten years in per Cent. of Premium.	Share Capital.	
		Persons.	Sums.	Persons.	Sums.	Persons.	Sums.		Per-sons.	Sums.	Abso-lute.	Per Cent. of Insured Sums at end of Year.	In General.		Reserve and advanced Premiums.	Clear Surplus.	Nominal.		Paid up.	
													Amount.	Per Cent. of Sums at end of Year.						
1827	Gotha	20,093	£ 4,579,914	1,363	£ 368,357	20,841	£ 4,792,614	220,935	£ 107,100	9,032	£ 4.09	1.88	£ 1,278,969	26.68	£ 1,038,444	£ 210,359	£ 72,857	£ 7,286		
1828	Lubeck . .	5,503	880,648	2,005	199,838	6,936	984,571	42,784	24,725	5,502	12.86	5.59	105,573	10.72	105,573	None	{ 0.251 { Assured On Sum	Mutual		
1830	Leipzig . .	4,749	772,285	324	47,100	4,881	786,785	37,067	23,257	2,319	6.25	2.95	226,961	28.85	193,381	23,065	Mutual	Mutual		
1830	Hannover . .	*2,882	249,529	*96	9,414	2,889	251,086	7,344	8,157	?	?	?	43,646	17.34	?	?	Mutual	Mutual		
1834	(1857-58) Trieste . . .	13,600	777,428	11,200	257,143	14,400	477,423	?	?	?	?	?	?	?	?	?	400,000	?		
1836	(General) Berlin	8,189	1,406,913	508	119,686	8,390	1,469,486	70,251	37,600	5,143	7.32	3.50	322,400	21.94	267,198	55,202	14½ of the Capital	28,571 of the Loan Bank.		
1836	Munich . .	2,315	247,208	270	30,645	2,424	262,278	49,714	6,024	?	?	?	41,789	15.93	?	?	Mutual	Mutual		
1839	Vienna . .	8,040	331,839	2,801	115,348	10,419	426,963	15,843	7,328	2,000	12.62	4.68	40,116	9.39	?	?	Mutual	Mutual		
1842	Brunswick . .	966	74,600	74	5,929	1,020	79,311	13,000	943	?	?	?	123,86	15.62	?	?	Mutual	Mutual		
1844	Frankfort . .	1,156	220,177	227	47,291	1,336	256,637	11,984	4,716	1,337	11.16	5.21	11,159	4.35	?	?	24,489	24,489		
1845	Hamburg . .	11,400	138,106	1,180	17,450	14,415	139,384	4,614	2,893	1,476	31.79	10.59	4,402	3.16	?	?	35,714	4,587		
1847	(Dannonia) Hamburg . .	*5,184	602,821	1,423	159,945	*6,235	716,880	26,591	9,847	5,329	20.04	7.43	49,793	6.94	?	?	71,429	7,143		
1852	(Janus) Leipzig . .	*991	68,627	*388	30,821	*1,259	95,447	5,311	1,046	1,855	34.92	19.44	10,230	..	18,162	None	85,714	12,850		
1853	(Crestonia) Schwerin . .	*217	38,114	*93	15,400	*302	51,900	1,441	72	?	?	?	2,584	4.98	1,191	892	14,286	1,429		
1853	Cologne . .	2,500	742,540	1,000	277,218	3,400	975,262	27,143	8,348	?	?	?	78,236	8.05	58,495	?	869,714	173,943		
1854	(Concordia) Stuttgart . .	1,187	186,343	379	71,200	1,539	247,461	9,388	2,384	645	6.87	2.60	18,228	7.36	11,418	6,810	Mutual	Mutual		
1854	Halle	*1,378	137,007	*629	63,945	*1,868	182,956	8,593	5,911	2,901	33.76	15.85	4,067	2.22	9,265	None	28,571	?		
1855	(Iduna) Darmstadt . .	784	39,386	108	11,901	861	49,720	1,974	694	?	?	?	3,157	..	?	?	Capital of the Annuity Society	55,400		
1856	Magdeburg . .	*408	72,793	*453	482,018	*933	154,311	45,000	500	?	?	?	4,302	2.79	4,993	..	282,000	55,400		
	Total . .	71,547	11,560,908	13,601	1,930,649	81,348	12,893,083	509,007	1,510	251,545	2,253,088	

* Policies.

† Approximated.

TABLE II.—*Showing the Gross Premium per Cent., the Average Dividends,*

Established.	Name of Company.	Average Dividend per Cent.	Age 25.			Age 30.			Age 35.		
			Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.
1827	Gotha	27 ⁶ / ₁₀ <i>Old Tariff: 0.251</i> <i>on sum assured</i>	2.356	0.650	1.706	2.633	0.727	1.906	2.969	0.819	2.150
1828	Lubeck	<i>New Tariff: non profit, 1857</i>	2.403	0.251	2.152	2.669	0.251	2.418	2.992	0.251	2.741
1830	Leipzig	15	2.356	0.353	2.003	2.633	0.395	2.238	2.969	0.445	2.524
1834	Trieste (Assicurazioni Generali) }	Non profit	..	..	2.14	..	..	2.42	..	..	2.76
1836	Berlin	<i>Old Tariff: 14¹/₂</i> <i>New Tariff, 1854:</i> Not yet divided	2.406	0.349	2.057	2.672	0.387	2.285	2.992	0.434	2.558
		Non profit	..	..	2.000	..	..	2.283	..	..	2.658
1836	Munich	Non profit	..	..	2.167	..	..	2.433	..	..	2.750
1839	Vienna (Mutual) ..	c. 13	2.150	0.279	1.871	2.483	0.323	2.160	2.883	0.375	2.508
1842	Brunswick	c. 6	2.125	0.127	1.998	2.382	0.143	2.239	2.722	0.163	2.559
1844	Frankfort	Non profit	..	..	1.992	..	..	2.242	..	..	2.550
1845	Hamburg	Non profit	..	..	1.917	..	..	2.175	..	..	2.483
	(Hammonia) }										
1847	Hamburg (Janus) ..	Non profit	..	..	1.950	..	..	2.225	..	..	2.542
1851	Trieste (Azienda Assicuratrice) }	Non profit	..	..	2.12	..	..	2.40	..	..	2.76
1852	Vienna (First Austrian Assurance Company) }	Non profit	..	..	2.100	..	..	2.383	..	..	2.717
1852	Leipzig (Teutonia)	Not yet divided	2.181	?	?	2.500	?	?	2.861	?	?
1853	Trieste (Riunione Adriatica di Sicurtà)	Non profit	..	..	1.96	..	..	2.25	..	..	2.57
1853	Cologne	Non profit	..	..	1.783	..	..	2.042	..	..	2.383
1853	Schwerin	Not yet divided	2.203	?	?	2.521	?	?	2.906	?	?
1854	Halle	Not yet divided	2.192	?	?	2.500	?	?	2.861	?	?
1854	Stuttgart	Not yet divided	2.230	?	?	2.457	?	?	2.760	?	?
1855	Darmstadt	Non profit	..	..	1.750	..	..	2.017	..	..	2.350
1856	Magdeburg	Non profit	..	..	1.867	..	..	2.083	..	..	2.358
1856	Erfurt	Non profit	..	..	1.758	..	..	2.008	..	..	2.333
1857	Stettin	Non profit	..	..	1.817	..	..	2.075	..	..	2.408
1857	Frankfort	Non profit	..	..	1.883	..	..	2.125	..	..	2.425
	(Providentia) }										
1857	Zurich	Non profit	..	..	2.174	..	..	2.439	..	..	2.778
	Average Premium	..	2.249	..	1.886	2.535	..	2.215	2.885	..	2.536

and the Net Premium after Reduction, in the German Life Assurance Companies.

Age 40.			Age 45.			Age 50.			Age 55.			Age 60.		
Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.	Gross Premium.	Dividends.	Net Premium.
3386	0.935	2.451	3961	1.093	2.868	4733	1.306	3.427	5742	1.585	4.157	7161	1.976	5.185
3400	0.251	3.149	3894	0.251	3.643	4531	0.251	4.280	5317	0.251	5.066	6367	0.251	6.116
..	..	2.928	..	..	3.564	..	..	4.417	..	..	5.561	..	..	7.133
3386	0.508	2.878	3961	0.594	3.367	4733	0.710	4.023	5742	0.861	4.881	7161	1.074	6.087
..	..	3.21	..	..	3.81	..	..	4.66	..	..	5.78	..	..	7.25
3400	0.493	2.907	3898	0.565	3.333	4533	0.657	3.876	5317	0.771	4.546	6367	0.923	5.444
3333	?	?	3950	?	?	4750	?	?	5858	?	?	7417	?	?
..	..	3.150	..	..	3.758	..	..	4.558	..	..	5.650	..	..	7.142
..	..	3.183	..	..	3.750	..	..	4.517	..	..	5.533	..	..	6.933
3333	0.433	2.900	3950	0.513	3.437	4733	0.615	4.118	5.667	0.737	4.930	6.967	0.906	6.061
3187	0.191	2.996	3805	0.228	3.577	4.660	0.280	4.380	5.854	0.351	5.503	7.479	0.449	7.030
..	..	2.950	..	..	3.483	..	..	4.192	..	..	5.142	..	..	6.422
..	..	2.875	..	..	3.400	..	..	4.097	..	..	5.000	..	..	6.208
..	..	2.950	..	..	3.425	..	..	4.100	..	..	5.125	..	..	6.492
..	..	3.24	..	..	3.84	..	..	4.64	..	..	5.70	..	..	7.23
..	..	3.167	..	..	3.767	..	..	4.550	..	..	5.633	..	..	7.183
3300	?	?	3900	?	?	4.667	?	?	5.624	?	?	6.833	?	?
..	..	2.99	..	..	3.62	..	..	4.35	..	..	5.55	..	..	7.07
..	..	2.825	..	..	3.417	..	..	4.208	..	..	5.267	..	..	6.692
3391	?	?	4005	?	?	4.802	?	?	5.906	?	?	7.661	?	?
3317	?	?	3.850	?	?	4.600	?	?	5.750	?	?	7.200	?	?
3182	?	?	3.757	?	?	4.572	?	?	5.688	?	?	7.077	?	?
..	..	2.800	..	..	3.433	..	..	4.300	..	..	5.550	..	..	7.317
..	..	2.758	..	..	3.333	..	..	4.108	..	..	5.033	..	..	6.300
..	..	2.750	..	..	3.317	..	..	4.083	..	..	5.267	..	..	6.717
..	..	2.842	..	..	3.417	..	..	4.192	..	..	5.208	..	..	6.592
..	..	2.821	..	..	3.396	..	..	4.167	..	..	5.212	..	..	6.671
..	..	3.226	..	..	3.846	..	..	4.545	..	..	5.556	..	..	7.143
3329	..	2.954	3.903	..	3.513	4.665	..	4.252	5.679	..	5.254	7.063	..	6.627

CORRESPONDENCE.

ON A STATEMENT REVIVED IN MR. HODGE'S PAPER ON INTEREST, WITH REFERENCE TO THE AUTHORSHIP OF GRAUNT'S OBSERVATIONS.

To the Editor of the Assurance Magazine.

DEAR SIR,—When your last Number reached me, I was engaged in searching Capt. John Graunt's *Observations on the Bills of Mortality*, with a view to get some information on the *rising of the lights*, as to what it meant: those who read *Notes and Queries* will see why. A contributor to that Journal mentions a poor woman who told him she had had an attack of that disorder, but she "kept 'em down" with a *dose of shot*. Looking over your pages, I was seized with symptoms of the character described, on finding that Mr. Hodge, in his very able and elaborate paper on Interest, has revived the old story that Sir William Petty wrote Graunt's *Observations*. Fortunately, I had the remedy by me. I immediately took a dose of *Biographia Britannica*, a work which is, one page with another, much heavier than any shot, even had such globules been at hand.

The work just mentioned disposes of the assertion made by Burnet. Sir William Petty himself, in scores of places, refers to Graunt's work as Graunt's; and Petty himself, after Graunt's death, published an edition of Graunt's work, *as Graunt's*. To this edition he sometimes carelessly refers as to a work of his own, as editors will occasionally do: and this, with an insinuation of Anthony à-Wood, and a statement of Burnet, form the printed foundation of the story which, to my mind, the *Biographia Britannica* completely disposes of.

During the years immediately preceding the publication (1661) of Graunt's work, Sir William Petty was in office in Ireland, in Parliament, under impeachment, in retirement in Ireland, and, after the Restoration, in the Commission of Claims, a well-occupied body, we may be sure. That he could have helped Graunt while at work is as unlikely as that he—a political arithmetician above all things—should choose to publish a work of much labour and no offence under the name of another. They were close friends, and in early life Graunt was Petty's patron, and Petty may have suggested the inquiry, and may have discussed its conduct. Graunt was notorious as the author, and was chosen into the Royal Society in consequence: and the King, understanding that there was a hitch in the matter, on account of Graunt being in trade, signified to the Royal Society that if they found any more such tradesmen they should elect them 'without more ado.' This distinction, added to Graunt being a Papist, probably induced some ill-willers, who thought that Petty's intimacy would give the thing a face, to circulate the story which came to the ears of Burnet and Anthony à-Wood. The best proof that Petty did not write the book is the difference of style, knowledge, and opinion between the book itself, and the works published under Petty's name. Graunt differs from Petty in political economy, in several points; and, as to knowledge, Graunt *attributes the effect of the tremors of the telescope to the actual motion of the moon in her orbit*. He makes her go forwards and then start backwards a little,

like the hand of a clock, or a boat which is rowed by impulses. Would Petty, who was a competent mathematician, who lived among the astronomers, and who was himself an inventor of machines, have conceived this exquisite bit of knowledge; or, conceiving it, would he have published it at the very time when, owing to the meetings of the Royal Society (of which he was one of the first members of council) he was in almost daily communication with those who would have set him right? Either supposition is hardly possible.

Yours faithfully,

January 17th, 1859.

A. DE MORGAN.

ON THE INCONGRUITY EXISTING BETWEEN THE RATES OF PREMIUM CHARGED AT CERTAIN AGES AND THE BENEFITS ACCRUING THEREUNDER.

To the Editor of the Assurance Magazine.

SIR,—I should like to bring under your review a matter that I think hardly meets with the consideration it deserves among actuaries—viz., the incongruity that exists between the premiums charged at different ages on “bonus” policies, and the benefits to which they entitle the holder, where, as in the great majority of cases, these premiums are calculated with reference only to the principal sum assured, and the reversionary “bonus” is declared by annual additions which are periodically “vested” or added to the principal amount, forming the capital which determines the amount of bonus for the next succeeding period.

Where the bonus is at the rate of P per £1 per annum, computed at each period of t years, its progress may be stated thus:—

First period.

Sum assured	.	.	.	.	.	£1.
Annual bonus	.	.	.	.	.	$P=B_1$.

Second period.

Sum assured	.	.	.	.	.	$1+tP$.
Annual bonus	.	.	.	.	.	$P(1+tP)=B_2$.

Third period.

Sum assured	.	$(1+tP)+tP(1+tP)$	$= (1+tP)^2$.
Annual bonus	.	.	$P(1+tP)^2=B_3$, &c.

Allowing for the altered circumstance of the addition being made to the sum assured after the first term has elapsed, the identity of the above formula for it with that for the amount of £1, is obvious—the sum assured for the n th period being $(1+tP)^{n-1}$, and the annual bonus $P(1+tP)^{n-1}=B_n$.

By the ordinary commutation tables, the annual premium for such a benefit, at age x , is

$$\frac{M_x + B_1 R_x + (B_2 - B_1) R_{x+t} + (B_3 - B_2) R_{x+2t} + \dots \&c.}{N_{x-1}}$$

I send you the following results of this formula, deduced from the Carlisle 3 per Cent. Table, assuming the sum under the policy to be

£1,000, and that a bonus of £1. 10s. per cent. per annum is added thereto in the usual manner each five years. To avoid any invidious distinction, I have purposely chosen data that, as far as I know, do not accurately represent the operations of any Office.

The first column shows the (net) annual premium required to assure £1,000 at the ages stated; the second, the annual premium required to meet the increasing benefit above described; and the third, the ratio of the first to the second.

Age.	Premium for £1,000.	Premium for £1,000, with Bonus.	Ratio.
20	14·9358	24·3651	1·63
30	19·5192	29·6399	1·52
40	25·9932	36·8245	1·42
50	36·2236	47·7889	1·32
60	57·8955	70·1644	1·21

Assuming the Office to charge the premium in the first column with the ordinary "loading" of 30 per cent., it will be seen that, while the entrants at age 50 get a reasonable equivalent for their payments, those at the more advanced ages have to pay some 30 per cent. of the premiums of their more fortunate younger brethren of 20.

I remain, Sir,

Your most obedient servant,

Aberdeen, 1st February, 1859.

H. A. S.

ON THE FACILITIES AFFORDED IN THE COMMUTATION SYSTEM BY THE INTRODUCTION OF COLUMNS OF DIFFERENCES.

To the Editor of the Assurance Magazine.

SIR,—Although your correspondent, "Joshua Milne," will not admit the superiority of the columnar method in life contingency calculations, he has failed, I think, to prove that, even with the help of a complete set of temporary and deferred annuities, the "ancient" method gives facilities equal to those which are claimed for its rival. I regret that the examples which have been adduced, in illustration of the two methods, were not presented by the writers on both sides, with the operations in full, for the merits of each method could then have been better appreciated.

As the old method of computation is, doubtless, greatly facilitated by the tabulation of the annuities, temporary and deferred, so may the power of the columnar method be increased by the tabulation of the differences of the N and M columns, and the summation of those differences, to be used supplementally to the D and N table in its ordinary form. I have long been sensible of the importance of such tables (and doubtless it has been equally apparent to others), for, as far back as the early part of 1854, I tabulated the differences of the N and M columns for terms from 1 to 70 years, and from those differences formed new R and S columns.

As a discussion has recently taken place in your valuable *Journal* with regard to the relative merits of the old and the columnar methods, it may not be uninteresting to give a short account of the difference tables above

referred to; I therefore propose, if you deem it worthy of insertion, to lay before your readers a short description of the mode of computing them adopted by me, as well as a few formulæ illustrative of the advantages to be derived from such a supplement to the original table.

The tables consist of a series of columns, supplemental to the columns N, S, M, R, of the table in its ordinary form, and are calculated for every age, from 0 to 70 (*i. e.* commencing with 0—1 and terminating with 69—70), which is deemed sufficiently extensive for practical purposes.

At the time of computing them, I was not, nor am I at present, aware of any suggestion having been made for a similar undertaking, and am therefore entitled to claim originality, both for the construction of the tables, and for the adaptation of the common formulæ to them.

The table used as the basis of these supplemental tables is the English Life Table, No. 1, contained in the *Appendix to the Sixth Annual Report of the Registrar-General*, 1844, pp. 604-5 (8vo. edition).

With regard to the arrangement of the tables, it is necessary to state, that the one adopted by Dr. Farr, as regards columns N and S, has been followed;— N_x and S_x corresponding with N_{x-1} and S_{x-1} of Jones, Davies, and others; and the following relation will be found to subsist between the several columns, viz.:—

In the ordinary table.

$$N_x = D_x + D_{x+1} + \dots D_{x+z}; \quad z \text{ being the oldest age in the table.}$$

$$S_x = N_x + N_{x+1} + \dots N_{x+z}; \quad \text{,,} \quad \text{,,}$$

$$M_x = C_x + C_{x+1} + \dots C_{x+z}; \quad \text{,,} \quad \text{,,}$$

$$R_x = M_x + M_{x+1} + \dots M_{x+z}; \quad \text{,,} \quad \text{,,}$$

In the supplemental tables.

$$N_{x|n} = D_x + D_{x+1} + \dots D_{x+n-1}; \quad n \text{ being the age at which the risk will cease, and at which the table also terminates.}$$

$$S_{x|n} = N_{x|n} + N_{x+1|n} + \dots N_{x+(n-1)|n}; \quad \text{,,} \quad \text{,,}$$

$$M_{x|n} = C_x + C_{x+1} + \dots C_{x+n-1}; \quad \text{,,} \quad \text{,,}$$

$$R_{x|n} = M_{x|n} + M_{x+1|n} + \dots M_{x+(n-1)|n}; \quad \text{,,} \quad \text{,,}$$

The symbols $N_{x|n}$ and $M_{x|n}$ are used to express not simply an abridgment of the terms $N_x - N_{x+n}$ and $M_x - M_{x+n}$, as adopted by Professor De Morgan, Dr. Farr, and others, but rather as the index to the tabulated results of their differences. The symbols $S_{x|n}$ and $R_{x|n}$ * in like manner indicate the summation of the columns $N_{x|n}$ and $M_{x|n}$, and are equivalent to the result of the several terms $S_x - S_{x+n} - n N_{x+n}$ and $R_x - R_{x+n} - n M_{x+n}$, and must not be confounded with the abbreviated form of $S_x - S_{x-n}$ and $R_x - R_{x-n}$.

The columns of the supplemental tables bear the following relation to the corresponding columns of the original table:—

$$N_{x|n} = N_x - N_{x+n}.$$

$$S_{x|n} = S_x - S_{x+n} - n \cdot N_{x+n}.$$

$$M_{x|n} = M_x - M_{x+n}.$$

$$R_{x|n} = R_x - R_{x+n} - n \cdot M_{x+n}.$$

and were computed in the manner now to be explained.

* Professor De Morgan adopted the symbols $S_{x|n}$ and $R_{x|n}$ as an abbreviated form for $S_x - S_{x+n} - n N_{x+n}$ and $R_x - R_{x+n} - n M_{x+n}$.—*Companion to Almanac*, 1840, p. 8.

In practice, the above constants, distinguished by the antique type, would

be set down on a card and added to each line of the preceding column, by which means the several columns may be produced with great rapidity.

Verification of the work was obtained as follows:—

$$\begin{aligned} N_{0|n} &= N_0 - N_{0+n} \\ N_{1|n} &= N_{0|n} - D_0 \\ N_{2|n} &= N_{0|n} - D_0 - D_1 = N_{1|n} - D_1 \\ &\vdots \\ N_{x|n} &= N_{0|n} - D_0 - D_1 - D_2 \dots D_{n-1} = N_{x-1|n} - D_{n-1}. \end{aligned}$$

Further verification of columns $N_{x|n}$ was effected by the additions of columns $S_{x|n}$, the quantities of which being $N_{x|n} + N_{x+1|n} + N_{x+2|n} + \dots + N_{x+n-1|n}$, and agreeing with $S_x - S_{x+n} - nN_{x+n}$ of Table No. 1, further proved their accuracy.

Column $S_{x|n}$ was formed by addition, in the usual manner, and age 0 was checked by $S_x - S_{x+n} - nN_{x+n}$, and further verified by $S_{x|n} - N_{x|n} = S_{x+1|n}$.

Column $M_{x|n}$ was formed from column C, in the same manner as column $N_{x|n}$ from column D, and column $R_{x|n}$ by the same process as column $S_{x|n}$.

By the aid of the supplemental tables, the computer will find that in the cases for which they are especially intended,—viz., for finding values for periods short of the whole duration of life, all the terms in the usual formulæ required to reduce the value of a whole life assurance or annuity, whether for fixed or increasing sums, to the value of a temporary assurance or annuity, are rendered unnecessary: in other words, the expression for whole life risks will apply equally to temporary risks, by substituting $x|n$ for x , $x+n|n$ for $x+n$, &c.

Take, for example, one of the most simple cases:—the formula for the present value of a whole life annuity is $\frac{N_{x+1}}{D_x}$; for that of a temporary

annuity it is $\frac{N_{x+1} - N_{x+1+n}}{D_x}$, which, by the supplemental tables, becomes

$\frac{N_{x+1|n}}{D_x}$: thus saving one tabular entry and a subtraction, the importance of which, in forming a series of values, cannot fail to be appreciated.

In calculations in which both numerator and denominator are of a temporary character, a greater advantage will be gained. The common formula for the annual premium for a deferred temporary annuity is $\frac{N_{x+1+n} - N_{x+1+n+n'}}{N_x - N_{x+n}}$; but by these tables it becomes $\frac{N_{x+1+n|n'}}{N_{x|n}}$. By the former, four tabular entries and two subtractions are required; while by the latter, two tabular entries only produce the same result.

The facilities afforded by this new arrangement will, however, be more apparent from an example involving more elements in the calculation than the preceding cases. For a deferred annuity with return of premiums,

the common expression is $\frac{N_{x+1+n}}{N_x + R_{x+n} + nM_{x+n} - N_{x+n} - R_x}$; but by the supplemental tables it becomes $\frac{N_{x+1+n}}{N_{x|n} - R_{x|n}}$, agreeing, *mutatis mutandis*, with the formula for the annual premium for assuring a sum at death with return of all the premiums—viz., $\frac{M_x}{N_x - R_x}$.

It will therefore, I think, be apparent that columns $N_{x|n}$ and $M_{x|n}$ —giving, as they do, by inspection, the differences of the numbers opposite every present and increased age, from 0 to 70, of columns N and M of the table in its common form; and that columns $S_{x|n}$ and $R_{x|n}$, containing the summation of columns $N_{x|n}$ and $M_{x|n}$, in the same manner as columns S and R are the summation of columns N and M; and thus sustaining the same relation to each other in temporary cases as do columns N, S, M, R, of the ordinary table for cases involving the whole of life—afford the means of calculating assurances and annuities for terms, as concisely, and with as much facility, as those for the whole period of existence.

In conclusion, I annex a few formulæ adapted both to the ordinary and the supplemental tables, which will suffice to show their relative value, and indicate the great saving of labour effected by tables computed as here pointed out, over those in common use. There are, however, I am aware, a few cases in which no especial advantage is gained by the use of the new tables; but although, in such cases, they are not serviceable to the same extent as in others, they will, nevertheless, be found useful for independent verification of computations by the common formulæ.

FORMULÆ.

Annual premium to assure £1 at death, if within n years:—

By ordinary table.

$$\frac{M_x - M_{x+n}}{N_x - N_{x+n}}.$$

By supplemental tables.

$$\frac{M_{x|n}}{N_{x|n}}.$$

Annual premium to assure £1 at death if between the ages of $x+n$ and $x+n+n'$:—

$$\frac{M_{x+n} - M_{x+n+n'}}{N_x - N_{x+n+n'}}.$$

$$\frac{M_{x+n|n'}}{N_{x+n+n'}}.$$

Annual premium for an assurance for n years, commencing at £A and increasing £P per annum:—

$$\frac{(A-P)(M_x - M_{x+n}) + P(R_x - R_{x+n} - n.M_{x+n})}{N_x - N_{x+n}} \quad \Bigg| \quad \frac{(A-P)M_{x|n} + P.R_{x+n}}{N_{x|n}}.$$

The same when $P=A$:—

$$\frac{A(R_x - R_{x+n} - M_{x+n})}{N_x - N_{x+n}}.$$

$$\frac{A.R_{x|n}}{N_{x|n}}.$$

Annual premium for an assurance of £A for $n+1$ years; after which it increases by £P for $n-1$ years, and then stops:—

$$\frac{(A-P)(M_x - M_{x+n+n'}) + P.(R_{x+n} - R_{x+n+n'} - n'.M_{x+n+n'})}{N_x - N_{x+n+n'}} \quad \Bigg| \quad \frac{(A-P)M_{x|n+n'} + P.R_{x+n|n'}}{N_{x|n+n'}}.$$

Temporary premium—£ p now and $n-1$ times more, n times in all—for £1 at death:—

$$\frac{M_x}{N_x - N_{x+n}}.$$

$$\frac{M_x}{N_{x|n}}.$$

Temporary premium, increasing by a proportion, to last n years only, last premium $\{1 + (n-1)\pi\}p$, for £1 at death:—

$$\text{or, } \frac{\frac{M_x}{N_x - N_{x+n} + \pi(S_{x+1} - S_{x+n-1} - n N_{x+n})}}{(1-\pi)(N_x - N_{x+n}) + \pi(S_x - S_{x+n} - n N_{x+n})} \quad \left| \quad \frac{M_x}{(1-\pi)N_{x|n} + \pi S_{x|n}} \right.$$

Annual premium for endowment assurance of £1 at end of n years or at previous decease; n payments:—

$$\frac{D_{x+n} + M_x - M_{x+n}}{N_x - N_{x+n}} \quad \left| \quad \frac{D_{x+n} + M_{x|n}}{N_{x|n}} \right.$$

Annual premium for an endowment payable at age $x+n$, with return of all the premiums if death take place previously; n payments in all:—

$$\frac{D_{x+n}}{N_x + R_{x+n} + n M_{x+n} - N_{x+n} - R_x} \quad \left| \quad \frac{D_{x+n}}{N_{x|n} + R_{x|n}} \right.$$

Extract from the Tables referred to. TERMINATING AT AGE 60.

Present Age.	$N_{x|n}$.	$S_{x|n}$.	$M_{x|n}$.	$R_{x|n}$.	Present Age.
0	950014.739	18321624.119	20411.3336	224834.5381	0
1	898740.739	17371609.380	12479.2936	204423.2045	1
2	856892.609	16472868.641	9919.2026	191943.9109	2
3	818822.669	15615976.032	8665.4586	182024.7083	3
4	783115.819	14797153.363	7817.8420	173359.2497	4
5	749296.149	14014037.544	7232.1306	165541.4077	5
6	717047.909	13264741.395	6778.2141	158309.2771	6
7	686192.119	12547693.486	6426.9586	151531.0630	7
8	656586.469	11861501.367	6153.8230	145104.1044	8
9	628116.589	11204914.898	5940.7591	138950.2814	9
10	600688.489	10576798.309	5774.8262	133009.5223	10
11	574225.449	9976109.820	5645.5128	127234.6961	11
12	548662.859	9401884.371	5519.9659	121589.1833	12
13	523970.069	8853221.512	5398.7566	116069.2174	13
14	500117.489	8329251.443	5254.6329	110670.4608	14
15	477104.159	7829133.954	5103.1535	105415.8279	15
16	454912.329	7352029.795	4952.9703	100312.6744	16
17	433517.029	6897117.466	4804.7413	95359.7041	17
18	412893.399	6463600.437	4657.8927	90554.9628	18
19	393017.309	6050707.038	4512.4698	85897.0701	19
20	373865.319	5657689.729	4369.0678	81384.6003	20
21	355414.659	5283824.410	4227.1548	77015.5325	21
22	337643.219	4928409.751	4087.2876	72788.3777	22
23	320529.519	4590766.532	3948.4541	68701.0901	23
24	304052.709	4270237.013	3812.1885	64752.6360	24
25	288192.529	3966184.304	3677.0261	60940.4475	25
26	272929.299	3677991.775	3543.4820	57263.4214	26
27	258243.909	3405062.476	3412.0268	53719.9394	27
28	244117.809	3146818.567	3282.2150	50307.9126	28
29	230532.969	2902700.758	3154.0624	47025.6976	29
30	217471.879	2672167.789	3027.9945	43871.6352	30
31	204917.539	2454695.910	2903.1986	40843.6407	31
32	192853.429	2249778.371	2780.4841	37940.4421	32
33	181263.509	2056924.942	2659.4587	35159.9580	33
34	170132.189	1875661.433	2540.1280	32500.4993	34
35	159444.349	1705529.244	2422.8515	29960.3713	35
36	149185.273	1546084.895	2306.9206	27537.5198	36
37	139340.684	1396899.622	2193.0264	25230.5992	37

Extract from the Tables referred to—(continued).

Present Age.	$N_{x|n}$.	$S_{x|n}$.	$M_{x|n}$.	$R_{x|n}$.	Present Age.
38	129896·709	1257558·938	2081·1486	23037·5728	38
39	120839·872	1127662·229	1970·9507	20956·4242	39
40	112157·084	1006822·357	1862·4296	18985·4735	40
41	103835·627	894665·273	1755·8788	17123·0439	41
42	95863·148	790629·646	1650·9866	15367·1651	42
43	88227·647	694966·498	1548·0273	13716·1785	43
44	80917·467	606738·851	1446·9774	12168·1512	44
45	73921·280	525821·384	1347·8129	10721·1738	45
46	67228·087	451900·104	1250·5098	9373·3609	46
47	60827·201	384672·017	1155·0437	8122·8511	47
48	54708·244	323844·816	1061·3902	6967·8074	48
49	48861·128	269136·572	969·5246	5906·4172	49
50	43276·065	220275·444	879·6504	4936·8926	50
51	37943·540	176999·379	791·7295	4057·2422	51
52	32854·316	139055·839	705·7244	3265·5127	52
53	27999·422	106201·523	621·3893	2559·7883	53
54	23370·146	78202·101	539·1052	1938·3990	54
55	18958·030	54831·955	458·6274	1399·2938	55
56	14754·862	35873·925	372·6612	940·6664	56
57	10760·094	21119·063	282·1509	568·0052	57
58	6972·152	10358·969	189·9551	285·8543	58
59	3386·817	3386·817	95·8992	95·8992	59

I am, Sir,

Your obedient servant,

Eagle Life Office,
1st March, 1859.

SAMUEL L. LAUNDY.

NEW GERMAN WORKS ON LIFE ASSURANCE.

To the Editor of the Assurance Magazine.

SIR,—I wish to direct your attention to two new German publications referring to life assurance—1. *Die Lebensversicherungs Praxis* (the Practice of Life Assurance), by Dr. August Wiegand, the able Director of the Life Insurance Society “Iduna,” at Halle. This book is principally addressed to life insurance agents, to explain to them the means they should take to extend the practice of life assurance, which, you know, is in Germany still used on a very limited scale. Dr. Wiegand is renowned for his capacity in treating scientific questions in a popular way, and there can be no doubt this little work will do a great deal of good. It consists of two parts. The first explains the essence and the importance of life insurance in general; it enumerates the different kinds of life assurance, and then points out to persons of different ranks of life the peculiar advantages they may derive therefrom: the second part teaches the agent how to manage, and gives him a complete plan to overcome the difficulties and prejudices which oppose themselves to his activity. You may best judge about the book if I add the contents, according to the index, and if I state that all the chapters are excellently executed:—1, the first beginning of life assurance—the Sterbecassen (a kind of friendly Societies); 2, on what principles they are generally established; 3, their objects; 4, life insurance, single life; 5, for a short duration;

6, endowments; 7, annuities; 8, survivorships; 9, survivorship annuities; 10, advantages to landed proprietors; 11, to merchants; 12, to physicians, lawyers, Government officials; 13, to tradespeople; 14, to labourers and workmen; 15, to children; 16, advantages in special cases; 17, to the rural population; 18, to rich people; 19, advantages in general; 20, the aim of the agent; 21, his own instruction; 22, advertisements; 23, conversation about life insurance; 24, letters about it; 25, prejudices; 26, how to prevent bad business; 27, filling up proposals, &c.; 28, activity of agents.

The other book has the title—*Grundzüge dar auf menschliche Sterblichkeit gegründeten Versicherungswesens* (Principles of Insurance contingent on Human Mortality), by Dr. Ph. Fischer, Oppenheim-on-Rhine. Of this work, only a part of the first division has been published, containing a detailed investigation of the different methods of determining the mortality. This chapter is executed in a satisfactory way, and shows the Doctor to be a perfect master of the subject. The second division is intended for the theory and practice of insurance, and will probably be of high interest.

A friend of mine, Dr. K. Heym, of Leipzig, who is entitled to great praise for his publications about life insurance matters, has favoured me, some weeks ago, with a letter containing a treatise concerning the computation of premiums for survivorship assurance. As far as I know, his formulæ are new—at least, I do not remember ever to have seen them in any work that has come under my notice—and, by his permission, I send you a translation of it,* which, I think, will not be devoid of interest for your readers, as the computations made according to the generally-used methods require a long process, and are not at all adapted for logarithms.

I am, Sir,

Your obedient Servant,

Hamburg, 20th Jan., 1859.

WILHELM LAZARUS.

AS TO A CERTAIN FIRE INSURANCE AND THE MODE OF SETTLING A LOSS UNDER IT.

To the Editor of the Assurance Magazine.

SIR,—I send enclosed the particulars of a loss which lately happened in a foreign city, and I think, from its peculiarities, it is deserving of record in your valuable *Magazine*. I wish also to invite remarks on the correctness of the settlement.

I am not sure that the Offices have *all* fulfilled the conditions of their policies, as it is questionable whether those Offices which have effected the insurances *without* the *pro ratâ* clause in their policies should not have paid the deficiency allotted to H, the assured, by those Companies which have that clause in their policies.

B's apportionment, I think, is right, so far as his own Office is concerned; and was presumed to be right in regard to the others, until it was discovered that the *pro ratâ* condition was not in every policy.

C appears to have overlooked the specific insurance on L by D.

* The formulæ communicated by our correspondent so closely resemble those given by Mr. Chisholm in vol. i., part 3, of his recently-published *Commutation Tables*, that it is needless to repeat them here. A comparison of the two works would, no doubt, be curious and instructive.—ED. A. M.

D appears to have overlooked the fact that B's policy contained the *pro ratâ* condition.

The details of this settlement may be interesting to those who have given their attention to the settlement of losses under average policies.

I am, Sir,

Your obedient servant,

R. B. F.

Pro ratâ condition.

"When, in case of loss by fire, the insured goods are valued at more than the sum insured, and some portion of the goods are saved, the owner shall be considered as his own insurer for the excess, and shall, in consequence, bear his share of the loss *pro ratâ*."

STATEMENT.

Office.	Insurances.	Rigsmont Dollars.	
A, On merchandise in warehouses communicating, A to L	ditto	40,000.	No <i>pro ratâ</i> condition.
B, Ditto,	ditto	30,000.	With <i>pro ratâ</i> condition.
C, Ditto,	ditto	38,000.	No <i>pro ratâ</i> condition.
D, On merchandise in warehouse L		10,000.	No <i>pro ratâ</i> condition.
On merchandise in all other warehouses, A to K		85,000.	
E, On sugars in all warehouses, A to L		30,000.	With <i>pro ratâ</i> condition.
		<u>Rd. 233,000.</u>	

H, the assured.

The absence of the *pro ratâ* condition from the policies of Offices A, C, and D, was not known to B until after the settlement.

Total value of goods, at time of fire, Rd. 233,928, 3 marks, and 2 skillings,* viz.:—

Sugars (none in L)	Rd. 138,357	3	12
Merchandise in L	6,827	2	6
Ditto, in A to K	88,743	3	0
	<u>Rd. 233,928</u>	<u>3</u>	<u>2</u>

Loss.

On sugars	Rd. 84,719	0	1
On merchandise in L	6,827	2	6
Ditto in A to K	49,953	3	0
	<u>Rd. 141,499</u>	<u>5</u>	<u>7</u>

APPORTIONMENT BY D.

Value of Sugar.	Loss on Sugar.	Insured by E.	Loss of E.
Rd. 138,357 : 3 : 12.	Rd. 84,704 : 4 : 3†	Rd. 30,000.	Rd. 18,366 : 2 : 10.

Loss in L.

Insured.	Insured by A, B, C.
Rd. 233,000	
Less E, 30,000	
<u>Rd. 203,000</u>	<u>Rd. 108,000</u>
covers loss, Rd. 6,827 : 2 : 6. Rd. 108,000 = Rd. 3,632 : 2 : 3.	

* 16 skillings = 1 mark, 6 marks = 1 dollar.

† An unexplained discrepancy.

Thus—

D, for Rd.10,000 0 0
A, B C, 3,632 2 3

Rd.13,632 2 3 covers Rd.6,827 : 2 : 6. Rd.10,000 0 0 pays Rd.5,008 1 8
3,632 2 3 pays 1,819 0 14

Rd.6,827 2 6

Loss in A to K.

Floating Policies in D . . . Rd.85,000 0 0
A, B, C, cover . . Rd.108,900 0 0
less, paid . . 1,819 0 14

106,180 5 2

Rd.191,180 5 2

Total loss . . . Rd.141,485 3 9 (discrepancy in sugar account.)

E paid . Rd.18,366 2 10

Paid on L 6,827 2 6

25,193 5 0

Rd.116,291 4 9 Thus, Rd.85,000 loses Rd.51,703 5 14

And on L 5,008 1 8

Total loss to Office D . Rd.56,712 1 6

APPORTIONMENT BY C.

Loss on merchandise	Rd.56,880	58 sk.	} discrepancy unexplained.
„ sugars	85,205	84	
	Rd.142,086	46	

Sugars valued at Rd.138,357 : 60; loss, Rd.85,205 : 84; loss = $61\frac{3}{5}$ per cent.

E therefore pays Rd.18,480—

Gross Loss	Rd.142,086	46
E pays	18,480	0

For other Offices . . . Rd.123,606 46

A insures Rd.40,000	Loss, Rd.24,355	92
B „ 30,000	18,266	93
C „ 38,000	23,138	16
D „ 95,000	57,845	37

Rd.123,606 46

APPORTIONMENT BY E

(of Sugar Loss), not known.

APPORTIONMENT BY B, AND ADOPTED BY A.

Loss on Goods (Sugars excepted) in all Warehouses (L excepted).

Whole value of goods, Rd.233,928 : 3 : 2.

Value of goods (sugar excepted), A to K, Rd.88,743 : 3; loss thereon, Rd.49,953 : 3.

Office.	Insurance.	Rateable proportion of Insurance applicable to Warehouses A to K, on Goods (Sugar excepted).	Share of Loss on Goods (Sugar excepted) in A to K.
A	Rd. 40,000 0 0	Rd. 15,174 3 0	Rd. 10,169 3 0
B	30,000 0 0	11,381 0 0	7,627 1 4
C	38,000 0 0	14,415 4 7	9,661 0 8
H, assured..	928 3 2	352 1 4	236 0 0
Goods in all warehouses (L excepted), Rd. 227,101 : 12.			
D	85,000 0 0	33,215 1 0	22,259 4 4
		Rd. 74,538 3 11	Rd. 49,953 3 0

Loss on Sugars.

Whole value of goods, Rd. 233,928 : 3 : 2.

Sugars in A to K (none in L), value Rd. 138,357 : 3 : 12; loss thereon, Rd. 84,719 : 0 : 1.

Office.	Insurance.	Rateable proportion of Insurance applicable to Sugars.	Share of Loss on Sugars.
A	Rd. 40,000 0 0	Rd. 23,658 0 0	Rd. 13,708 1 2
B	30,000 0 0	17,743 3 0	10,281 1 0
C	38,000 0 0	22,475 0 9	13,022 4 11
H, assured..	928 3 2	549 1 4	318 0 10
E	30,000 0 0	30,000 0 0	17,382 5 10
Goods in all warehouses (L excepted), valued at Rd. 227,101 : 12.			
D	85,000 0 0	51,784 5 0	30,005 5 0
		Rd. 146,210 3 13	Rd. 84,719 0 1

Loss on Goods (Sugars excepted) in L.

Whole value of goods, Rd. 233,928 : 3 : 2.

Value of goods in L, Rd. 6,827 : 2 : 6; loss thereon, Rd. 6,827 : 2 : 6.

Office.	Insurance.	Rateable proportion of Insurance applicable to L.	Share of Loss in L.
A	Rd. 40,000 0 0	Rd. 1,167 3 0	Rd. 604 4 12
B	30,000 0 0	875 3 0	453 3 9
C	38,000 0 0	1,109 1 0	574 3 3
H, assured..	928 3 2	27 0 10	13 5 12
D	10,000 0 0	10,000 0 0	5,180 3 2
		Rd. 13,179 1 10	Rd. 6,827 2 6

Recapitulation of Risk.

Office.	A to K.		L.	Total.
	Goods.	Sugar.		
A	Rd.15,174 3 0	Rd.23,658 0 0	Rd.1,167 3 0	Rd.40,000 0 0
B	11,381 0 0	17,743 3 0	875 3 0	30,000 0 0
C	14,415 4 7	22,475 0 9	1,109 1 0	38,000 0 0
D	33,215 1 0	51,784 5 0	10,000 0 0	95,000 0 0
E .....	..	30,000 0 0	..	30,000 0 0
H, assured	352 1 4	549 1 4	27 0 10	928 3 2
				Rd.233,928 3 2

Recapitulation of Loss.

Office.	A to K.		L.	Total.
	Goods.	Sugar.		
A	Rd.10,169 3 0	Rd.13,708 1 2	Rd.604 4 12	Rd.24,482 2 14
B	7,627 1 4	10,281 1 0	453 3 9	18,361 5 13
C	9,661 0 8	13,022 4 11	574 3 3	23,258 2 6
D	22,259 4 4	30,005 5 0	5,180 3 2	57,446 0 6
E .....	..	17,382 5 10	..	17,382 5 10
H, assured	236 0 0	318 0 10	13 5 12	568 0 6
				Rd.141,499 5 7

	H has received.	H should have received.*
From A	Rd. 24,482 2 14	Rd. 24,482 2 14
" B	18,361 5 13	18,361 5 13
" C	23,138 1 0	23,258 2 6
" D	56,712 1 6	57,446 0 6
" E	17,382 5 10	17,382 5 10
	Rd. 140,077 4 11	Rd. 140,931 5 1

* It is questionable whether H should not also have received from A, C, D the difference between Rd. 140,931 : 5 : 1 and the total amount of loss, Rd. 141,499 : 5 : 7—

Say, from A	Rd. 139 2 6
" C	132 2 9
" D	296 1 7
	<u>Rd. 568 0 6</u>

INSTITUTE OF ACTUARIES.

PROCEEDINGS OF THE INSTITUTE.

Third Ordinary Meeting, Session 1858-59.—Monday, 31st January, 1859.

CHARLES JELlicoe, Vice-President, in the Chair.

The minutes of the last ordinary meeting were read and confirmed.

The Secretary announced several donations to the library.

The Chairman announced the following as the results of the annual examinations:—

Out of seven candidates for the matriculation examination, six passed, in the order of merit indicated below—

- | | |
|-----------------------------|----------------------------|
| 1. Horatio Nelson Grimley. | 4. Charles Bischoff. |
| 2. William Charles Mullins. | 5. William Booth. |
| 3. Claud George Laing. | 6. Horatio Edward Norfolk. |

Three candidates presented themselves for the second year's examination and passed in the following order—

Marcus Nathan Adler.
Stewart Helder.
William Bell Grant.

For the third year's examination, two candidates appeared, and both passed, as follows:—

William King.
Stephen Macdonnel Clare.

These gentlemen are now entitled to certificates of competency.

The undermentioned gentlemen, duly nominated at the last ordinary meeting, were elected members of the Institute, viz.:—

Official Associate—Philip Curtis.

Associates.

William Roger Adams.	Benjamin Newbatt.
Horatio Nelson Grimley.	Horatio Edward Norfolk.

George Stewart, Esq. was elected a Fellow, in conformity with Rule VI.

A paper by Mr. Willich, "On the expectation of life," was read.

Mr. Archibald Day read a paper "On the determination of the rates of premium for assuring against issue."

Fourth Ordinary Meeting, Session 1858-59.—Monday, 28th February, 1858.

JOHN FINLAISON, Esq., President, in the Chair.

The minutes of the last ordinary meeting were read and confirmed.

The Secretary announced several donations to the library.

The undermentioned gentlemen, duly nominated at the last ordinary meeting, were elected members of the Institute, viz.:—

Associates.

Thomas Corbett.	J. Dalton Easum.
-----------------	------------------

Mr. Thomas Miller read a paper entitled "A Chapter in Fire Insurance: 'specific' and 'average.'"

THE
ASSURANCE MAGAZINE,
AND
JOURNAL
OF THE
INSTITUTE OF ACTUARIES.

On a Property of Mr. Gompertz's Law of Mortality. By
PROFESSOR DE MORGAN.

IT is commonly known that in calculating an annuity on three joint lives, two of the lives are made to count as one life of the same annuity value; and that the result is approximately true. Twenty years ago (*Phil. Mag.*, Nov., 1839), I showed that if the law of mortality explained by Mr. Gompertz were accurately true for the whole of life, this substitution of one life instead of two would also be accurately true. I now repeat the same proposition in a more general form.

Required the law of mortality under which the table of two lives follows the same law as the table of one life—that is, in which the chance of two or more lives surviving a given term is always equal to the chance of some one life, older than either, surviving a term of the same length. Had any one, observing the usual rule for determining an annuity on three lives, had the curiosity to inquire what is the law of mortality for which it is accurately true, he would have arrived at Mr. Gompertz's law of mortality by a totally different route. I do not think it right to occupy space by a very full development of the demonstration: the following will be enough for anyone who has an ordinary acquaintance with functional algebra and the differential calculus.

Let the number living at the age x be $\varepsilon^{\phi x}$, ϕx being an un-

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known function of x . Let the chance of lives aged x and y both surviving n years be equal to that of a single life of the age z surviving n years— z being an unknown function of x and y , but not of n . We have then,

$$\epsilon^{\phi(x+n)-\phi x} \times \epsilon^{\phi(y+n)-\phi y} = \epsilon^{\phi(z+n)-\phi z};$$

$$\text{or, } \phi(x+n) + \phi(y+n) - \phi x - \phi y = \phi(z+n) - \phi z.$$

This being true for all values of n , and x, y, z , being independent of n , differentiation with respect to n gives

$$\phi'(x+n) + \phi'(y+n) = \phi'(z+n).$$

Now this equation is not possible for all values of x, y, n , except under the condition that $\phi'(x+n)$ is of the form $fx.Fn$; and even this form is limited to $fx.fn$, since x and n must be transposable without alteration of value in $\phi'(x+n)$. Hence $\phi'x$ is $fx.f(0)$, whence fx is of the form $a\phi'x$; a being independent of x . Hence $\phi'(x+n)$ is $a^2\phi'x.\phi'n$, and $a^2\phi'(x+n)$ is always $a^2\phi'x.a^2\phi'n$, which it is known cannot be unless $a^2\phi'x$ be of the form ϵ^{cx} , whence ϕx is of the form $b\epsilon^{cx} + k$; b, c, k , being constants independent of x . Hence

$$\epsilon^{\phi x} = n^{\circ} \text{ living at age } x = \epsilon^{k+b\epsilon^{cx}} = dg^{qx},$$

to use Mr. Gompertz's letters; here $d = \epsilon^k$, $g = \epsilon^b$, $q = \epsilon^c$.

Mr. Gompertz's paper "On the Nature of the Function expressive of the Law of Human Mortality," read before the Royal Society, June 16, 1825, is not by any means so well known as it ought to be, even by actuaries. It is the first attempt at an hypothesis on the law of mortality from a physiological point of view. If of 10,000 persons of a given age, one may be expected to die in a week, while of 10,000 persons of a given older age two may be expected to die in a week, it is clear that the power of death over the second set is double of the same power over the first set. Another way of stating it is, that the power of the second set to oppose destruction is half of the power of the first set. Either phrase may be adopted, and either may be objected to; all that is meant is, that the fight between life and death which is always going on gives death twice as large a proportion of his possible victims in the second case as in the first. The *intensity of mortality* is twice as great in the second case as in the first. If l_x represent the number living at the age x , and if $fx.dx$ represent the *proportion* who die in the next interval dx , then fx may represent the intensity of mortality at the age x ; and we have $dl_x = -l_x fx.dx$, the negative sign being required to express that death diminishes the number of the living. The physiological law

assumed by Mr. Gompertz is, that the intensity of mortality gains equal proportions in equal times; so that in whatever ratio it is augmented in any given interval, it is augmented in the same ratio in any other interval of the same length. That is, $fx = aq^x$; a and q being independent of x . Hence

$$dl_x = -l_x a q^x dx, \quad \log. l_x = \text{const.} - \frac{aq^x}{\log. q},$$

whence the form $l_x = A.g^{q^x}$ is easily obtained; g being some quantity less than unity, and $\log. g \log. q.q^x$ being the intensity of mortality at the age x . The logarithms are Naperian.

In comparing his theory with tables, Mr. Gompertz found that it applies with singular accuracy through long periods, but requires a change of the constants at one or more periods. In the Carlisle Tables he found—the logarithms being common logarithms—

$$\text{From 10 to 60, } \log. l_x = 3.88631 - 10^{\overline{2}.75526 + .0126x}.$$

$$\text{From 60 to 100, } \log. l_x = 3.79657 - 10^{\overline{3}.74767 + .02706x}.$$

The law itself, when applied, indicates a slow change in the quantities supposed constant. Thus, taking the interval from 10 to 58 years of age, Mr. Gompertz found

$$\log. l_x = 3.89063 - 10^{\overline{2}.784336 + .0120948x}.$$

To return to the first view taken of this law in the present paper, the value of z , the age of the single life equivalent to the joint lives aged x and y , is to be determined from the equation

$$q^x + q^y = q^z; \quad \text{or, } z = \frac{\log. (q^x + q^y)}{\log. q}.$$

We can now institute comparisons by help of any table for which annuities have been calculated. Equal lives will be the most convenient. If $x = y$, we have

$$z = x + \frac{\log. 2}{\log. q};$$

that is, if Gompertz's hypothesis were true throughout the whole of life, without any change of constants, the seniority of the life equivalent to two equal lives would always be of the same amount for every kind of annuity and every rate of interest. In the case of $\log. q = .0126$, it would be $.30103$ divided by $.0126$, or 24 years very nearly. For two lives aged 20, at 3 per cent., the equivalent single life, for an annuity on the whole lives, is close to 37 years, with a seniority of only 17 years. For a life annuity of 10 years, the seniority will be found to be 21 years, and the same for an

annuity of 40 years. The comparisons are so easy that I do not think it necessary to give more examples. This last theorem will materially assist in judging of the closeness of the approximation, and in making a first attempt at the value of q , when the table of facts is given.

It may be suspected that a value of q derived from a considerable average of short annuities would, when combined with properly altered values of A and g , give a table still nearer to the original than that obtained by Mr. Gompertz's constants, though this last is surprisingly near. Very slight changes in the value of q make differences of years in the *seniority*. The effect of the rate of interest is comparatively small. At 6 per cent., with lives both aged 20, and an annuity for the whole life, the seniority is 18 years; at 3 per cent., 17, as above.

The law of uniform seniority, as it may be called, is true for any given and uniform interval of age. If $y = x + h$, we have

$$z = x + \frac{\log. (1 + q^h)}{\log. q}.$$

On the Mortality amongst American Assured Lives. By SAMUEL BROWN, F.S.S., *Actuary of the Guardian Assurance Company.*

[Read before the Institute of Actuaries, 2nd May, 1859, and ordered by the Council to be printed.]

THE extension of life assurance in the United States, and, especially, the more or less successful attempts of English Companies to compete with the American Companies, render an inquiry into the mortality of American assured lives of the greatest interest to the members of this Institute. The question assumes the greater importance, because, from various reasons, the population statistics of the United States have hitherto been, and will for a long period probably continue to be, in a very imperfect state, notwithstanding the talents and skilful labours of the able men to whom the collection of the data in the different censuses has been entrusted, and the readiness of the people to afford the information desired. The marvellous rapidity with which the population has there increased; the vast extent of the country showing such a diversity of soil and climate; the conversion of the country into town districts, or of wild insalubrious localities into lands reclaimed and rendered

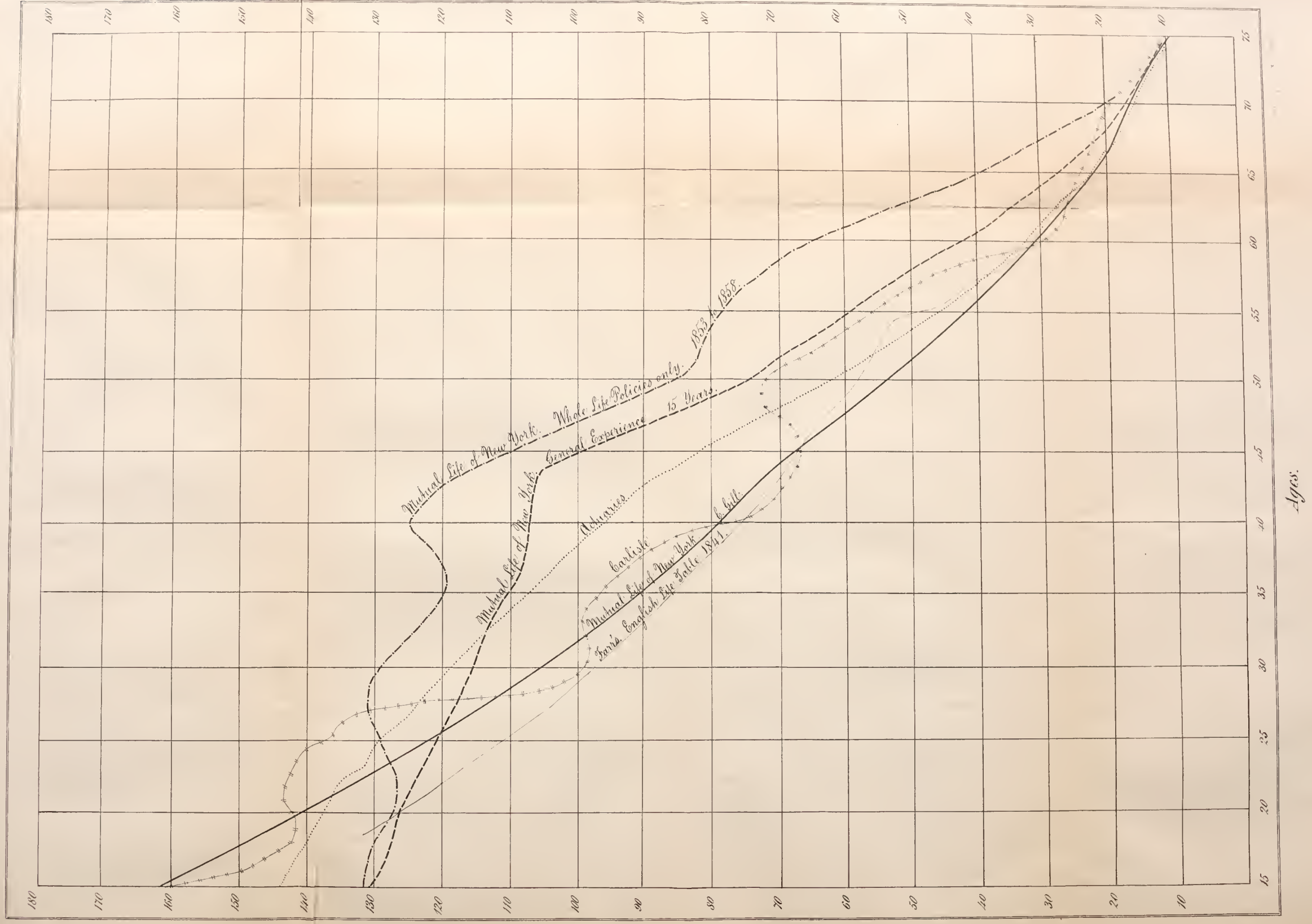
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Diagram. Showing the experience of mortality in the
Mutual Life Insurance Company of New York, compared with other Tables.

Numbers out of which one person will die in a year.



CLASS 1.—The New England States, New York, Pennsylvania, New Jersey, Delaware, Maryland, & Part of Virginia.

CLASS 2.—Michigan, Wisconsin, Illinois, Indiana, Ohio, Missouri, Kentucky, and Part of Arkansas & Tennessee.

CLASS 3.—Georgia, North & South Carolina, South Eastern States on the Atlantic.

CLASS 4.—Texas, Mississippi, Alabama, Florida, Louisiana (Southern States on the Gulf of Mexico).

CLASS 5.—The Western Territory, Texas, and California.

CLASS 6.—The Mississippi Valley, within 10 Miles of the Mississippi and Missouri Rivers north of 36°

CLASS 7.—Risks in Foreign Countries, Sea Risks, and all not included in the other Classes



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healthy by the industry of a dense population—are all so many obstacles to prevent our obtaining at present any Government statistics that could be relied on for the discussion of this grave question. Another serious difficulty is, not only the tendency of the young and enterprising to move from the States in which they were born, in order to open up new lands and lay the foundations of future States, but the tide of emigration, which, setting in from Europe, and especially from this country, overwhelms all the well-known laws of population which prevail in the old world, and disturbs all the calculations of the most acute political economist. It is easy to perceive that the influx of a large number of immigrants, mostly in the prime of life—some unmarried, though of marriageable age—some recently married, and others bringing with them families of grown-up children of various ages—would materially alter the social status of a people, according to the ages of the immigrants on their arrival, and the early period at which a new generation might be found mingling with the native population. In the census of the United States, taken in 1850, the first attempt was made to distinguish the “native born” from the “foreign” population; and it was found, that amongst the free inhabitants, whilst 17,737,505 were natives of the soil, the large number of 2,210,028 were born in foreign countries. Of this number, Great Britain contributes more than half, as may be seen by the following summary:—

		Per cent.
Natives of Ireland	961,719	43·50
„ Germany	573,225	25·93
„ England	278,675	12·61
„ British America	147,700	6·68
„ Scotland	70,550	3·19
„ France	54,069	2·44
„ Wales	29,868	1·35
„ other countries	95,022	4·30
	2,210,828	100·

Mr. Joseph C. G. Kennedy, who was the superintendent of the census of 1850—and whom many of us have pleasure in recalling to mind as present at the dinner given at Richmond, in 1851, by this Institute, to the representatives of British and foreign assurance interests, and, on behalf of the United States, returning thanks in an able speech—gives, in a *Report on the American Census*, some curious speculations as to the effect of this immigration. From an inspection of the returns at the State Department of the Custom House of New York, and other ports of entry, it appears

that comparatively few of the immigrants are above 45 years of age; that females under that age constitute only two-fifths of the whole number; that the total proportion of immigrants under 15 is 21·8 per cent.; from 15 to 30, 50·6 per cent.; and from 30 to 45 and upwards, 27·6 per cent. From various causes, the mortality of immigrants is greater than that of the land of their birth—which fact is proved alike by the American statistics collected in California, and from the severe ravages of the cholera in America among the “foreign” population. The large proportion of Irish immigrants, too—who are subject to a higher rate of mortality than the general population of England—would affect the results; but, making a deduction of 10 per cent. for these causes, and after allowing for the balance of re-emigration from Canada, it was found, by calculation, that the survivors of immigrants who entered the United States as permanent residents since 1790, would be about equal to the number above given as found existing by the census of 1850. How great a variation, having reference to the ages above stated, such an immigration would create in the law of population of the country at the last census, may be estimated from the fact, that the arrivals of foreign passengers in the ports of the United States amounted to no less than a million and a half in the ten years preceding 1850.

To this disturbing element must be added the roving tendency of the existing population to quit the States of their birth and migrate and settle in other States. Out of 17,736,792 free inhabitants, no less a number than 4,112,433 are recorded as being natives of other States; 26 per cent. of all the natives of Virginia, 36 per cent. of the natives of South Carolina, and 31 per cent. of the free inhabitants of North Carolina, were found beyond their own borders; and amongst the Northern States Vermont and Connecticut had sent out 25 per cent. of their native inhabitants to settle in other States.

It is evident, therefore, that until the taking of the census just quoted, no reliable data existed for computing life tables or furnishing even approximate materials for determining the true law of mortality in the various States of America. Two tables were, however, formed from the observations of the census of 1850, under the authority of Mr. Kennedy, for Massachusetts and Maryland; and a more recent one for Massachusetts, by Mr. E. B. Elliot, was published in the *Proceedings of the American Association for the Advancement of Science, held at Montreal in August, 1857.*

With regard to the former, it may be observed that the records of mortality only extend over the census year; and though it is considered to have been an average year for deaths, yet the assumption that the population, affected by so many causes of irregular movement, is to be taken as stationary, is one that greatly depreciates the value of any tables deduced therefrom. The rate of mortality observed over the whole of the States is so much less than that in any large part of Europe, that the statements must be received with some degree of allowance, especially as the deaths to the living in 1850 varied from 1 in 43 in Louisiana to 1 in 233 in Oregon. Still, the mortality of Maryland, comprising a population of 583,034, and showing a death-rate of 1·685 per cent., is considered by Mr. Kennedy to be a fair estimate of the standard of human life in the older settled States; and it is remarkable, that as to male life, it differs but little from Farr's English Life Table for 1841, whilst for female life it gives an expectation of from $1\frac{1}{2}$ to 2 years above the English Table. Another table was formed from the returns for Massachusetts for males and females separately. The following comparison of the expectation of life shows to what extent the American rate of mortality in the settled States corresponds with our own.

Expectation of Life.

Ages.	MASSACHUSETTS CENSUS, 1850.		MARYLAND CENSUS, 1850.		ENGLAND CENSUS, 1841.	
	Males.	Females.	Males.	Females.	Males.	Females.
0	38·3	40·5	41·8	44·9	40·2	42·2
20	40·1	40·2	39·7	42·1	39·9	40·8
40	27·9	29·8	25·8	29·5	26·6	27·7
60	15·6	17·	14·4	16·	13·6	14·4
80	5·9	6·4	6·2	7·	4·9	5·2

Mr. Kennedy's Report on the Census, from which the above statement is taken, was made 1st December, 1852; but since then, viz., 1st September, 1854, a very admirable statistical view of the United States, embracing their territory, population,—white, free, coloured, and slave,—moral and social condition, industry, property, and revenue—the detailed statistics of cities, towns, and counties,—being a compendium of the seventh census in 1850, and comparisons with the previous decennial censuses from 1790,—was presented to the Secretary of the Interior by Mr. J. B. D. De Bow, the then superintendent of the census. It was compiled in ac-

cordance with a resolution of the Senate, dated 12th July, 1854, and 50,000 copies were ordered to be printed. It gives a most complete abstract of the various matters comprised in the last census, and furnishes a table of the deaths in the census year at decennial periods of age for each separate State, which, compared with the living, would enable a life table to be formed for every State, provided the broad assumption that the population is stationary could be admitted. Mr. De Bow suggests, also, that the statistics of manufactures and mortality, which alone remain of the census, could be published in the same form, if ordered by the Senate, and would be ready by the following meeting of Congress. I am not aware, however, whether this proposed continuation was agreed to.

It is evident, from the preceding statements, that in carrying out the business of life assurance, the American Companies had no reliable statistics of their own, and were obliged to have recourse to the life tables already in use in the Old World. Accordingly, I find it stated in the Reports of one of the Companies, that the table in use was that generally adopted by the Life Assurance Companies of the United States, which was based on the Carlisle 4 per cent., with about 35 per cent. addition thereto. The Companies were sufficiently protected at early periods of their history, and even now, by the high rate of interest which has been obtained even on first-class securities. In the Mutual Life Assurance Company of New York, to which I shall have occasion to revert presently, the loans are stated to amount to 4,294,593 dollars, and are all bearing interest at 7 per cent. per annum; and the finance committee report, that, with a single exception,—in which the loss, if any, cannot be large,—no loan is known to be in jeopardy through the insufficiency of the security. This is one of the most prosperous and cautiously-conducted Companies in the States. The leading Companies, however, have been vigilantly watching to avail themselves of any data, either furnished by the State or supplied by their own experience, to prove the safety or correctness of the tables they used; and the life table which I have before alluded to as formed by Mr. Elliott to show the law of mortality in Massachusetts, is stated to be part of an original series which had been prepared for the New England Mutual Insurance Company of Boston, from extensive and reliable European and American data. It was calculated from official abstracts for 1855 of the movements of population in 166 of the 331 towns of the commonwealth of Massachusetts, in each of which the ratio of deaths to population

was more than 1 to 63, their aggregate population being two thirds of the entire State. On the 1st June, 1855, the total population was taken at 751,241, and the deaths during the year 16,086. The mortality represented was probably somewhat lower, through omissions in the registration, than what actually occurred; but as the observations extend over a large proportion of the more populous districts, it is concluded that the law of mortality does not differ much from that of the whole State, and that the errors will balance each other.

The *Fourteenth Annual Report*—relating to the registry and the returns of births, marriages, and deaths in Massachussets for 1855—and the *Abstract of the Census of the Commonwealth, taken on the 1st June, 1855*, prepared under the direction of the Hon. Francis De Witt, Secretary of the Commonwealth, and under the supervision of Dr. Nathaniel B. Shurtleff, of Boston, appear to be the first and only official Reports, whether State or national, in which the ages of the persons living or dying in the State have been distinguished by towns. In previous Reports, the distinction was by counties; and it is unfortunate that, in the census of that year, the enumeration was not made of the ages of each sex, though a very near approximation may be obtained by dividing the numbers of the sexes in the proportions indicated in the census of 1850. These observations form the foundation of the life table which Mr. Elliott recommends for life assurance purposes.

The table which has been employed by the courts of the Commonwealth in determining the value of life interests in estates, legacies, and pensions, and of reversions in heritable property, is one that was prepared by Dr. Edward Wigglesworth, from bills of mortality previous to 1789, in the States of Massachussets and New Hampshire, and which was published in the second volume of the *Memoirs of the American Academy of Arts and Sciences*. The most serious defect in its constitution was, that no allowance was made for the rapid increase of the population then going on.

From 1850 to 1855 the population of Massachussets has increased more rapidly than that of most countries of Europe; the annual rate of increase in that time was 2·63 per cent. After correcting the original returns for increase on account of migration, an adjusted table is produced, of which it will suffice for our present purpose to show the following comparisons with the Carlisle Table :—

Age.	NUMBER LIVING.		EXPECTATION OF LIFE.	
	Massachussets.	Carlisle.	Massachussets.	Carlisle.
0	10,000	10,000	39·8	38·7
5	7,146	6,797	50·2	51·3
10	6,873	6,460	47·1	48·8
15	6,726	6,300	43·	45·
20	6,437	6,090	39·9	41·5
30	5,748	5,642	34·	34·3
40	5,078	5,075	27·9	27·6
50	4,409	4,397	21·3	21·1
60	3,597	3,643	15·	14·3
70	2,475	2,401	9·4	9·2
80	1,059	953	5·	5·5
90	118	142	2·9	3·3
100	2	9	..	..

It appears that, from about age 5 to age 15, lower rates of mortality prevailed in Massachussets than is generally the case in European communities; that from age 15 to various ages between 35 and 50, the Massachussets rates are much higher than, after which they again fall somewhat below, the European rates. Under the age of 5 years, the mortality in Massachussets seems more intense than in Europe generally: from 3 to 15 it approaches closely to that of Sweden; from 17 to 45, nearer to Belgium, though higher; and after 45, nearer to, but lower than, the average English rates. As a whole, the mortality of Massachussets is better represented by that of England than of any other European State.

If the mortality in the New England Mutual Life Insurance Company, for which these tables were originally prepared, may be judged from the proportion of losses to sums at risk, it must be considered to present a highly favourable view of American assured lives; for during the last year (the Society having been established in 1844), the claims were only 87,300 dollars on assurances in force of 10,410,300 dollars, being only ·84 per cent. This rate, which is about the average of the last four years, corresponds only to the ages 15 to 20 in the Massachussets table.

Such is a description of the principal tables intended to represent the general law of mortality in the United States, any striking deviation from which would materially affect the prosperity or safety of the Assurance Companies. We now come to the consideration of how far it has been proved correct, or to what extent it differs from the experience of the Companies themselves.

The directors of the Mutual Benefit Life Insurance Company of Newark, New Jersey, have, with a laudable desire to promote

the real interests of life insurance, published, in their prospectus for 1858, the Company's experience for the 12 years of its existence. They profess their intention to continue the publication from time to time, and at another period to go more into detail, giving a classification of the places and general causes of death; and it would be very gratifying to find that the call which they make to other Companies to follow so honourable an example will be responded to. No good can ever come of the concealment of facts, which, if they tend to place the business of life assurance on a safer footing, must be a permanent advantage to the public, and which would prove the most effectual means of protecting the assured themselves from the ignorance of unskilful or the tricks of designing men. I should be glad to see in this country the noble example which a few leading Companies have set, in publishing their experience, more generally followed.

In the Mutual Benefit of New Jersey, a licence is required of the members to go on the seas or to pass beyond the settled limits of the United States, Canada, Nova Scotia, and New Brunswick; nor can they, between the 1st of July and 1st of November, without the consent of the Company, pass south of the southern line of North Carolina and Tennessee, or west of the Mississippi river, except in the settled regions of Iowa, Missouri, Kansas, Nebraska, and Minnesota, north of the 38th degree of latitude, and east of the 100th degree of west longitude. Permission is given to go, by any of the regular line of steamers or first-class sailing vessels, to Europe or to any of the American Atlantic ports north of the Capes of Florida, provided that the Company would assure residents at such ports at the tabular rates of premium.

The experience of the Company, as regards the mortality of the members, is worthy of observation, as the number of members has constantly been, on an average, 4,000, and in latter years 5,000. Lives have been carefully distinguished from policies: and attention has been given to ascertain with accuracy—(1) the number of persons who, at each age of life, took or renewed a policy by payment of the premium; (2) how many died within the year the policy had to run. Each age, therefore, includes new or recent selections, as well as those of earlier date, added together in each successive year of the Company's existence. The experience hitherto has been highly favourable, but the directors very properly add the caution to consider this fact in relation to the benefit of recent medical examination. In the 12 years from 1845 to 1856 are included 49,682 years of life, and 566 deaths. The proportionate

mortality amongst the members, computed for each year, would have been 646 by the Carlisle Table, and 602 by the experience of the seventeen London Offices. I here subjoin the Table of Experience, reserving its comparison with the more important data furnished by the Mutual Life Insurance Company of New York.

Experience of the Mutual Benefit Life Insurance Company, New York.

Age.	Persons Living.	Died.	PROBABLE DEATHS.		Age.	Persons Living.	Died.	PROBABLE DEATHS.	
			Carlisle.	Exp. of London Comp.				Carlisle.	Exp. of London Comp.
14	13	..	·1	·1	48	1,178	16	16·4	16·8
15	22	..	·1	·2	49	1,061	16	14·5	16·
16	42	1	·3	·3	50	961	16	12·9	15·3
17	47	..	·3	·3	51	848	11	12·1	14·3
18	66	1	·5	·5	52	771	6	11·7	13·8
19	87	2	·6	·6	53	706	13	11·4	13·5
20	112	2	·8	·8	54	623	13	10·5	12·7
21	188	4	1·3	1·4	55	547	3	9·8	11·9
22	288	3	2·	2·2	56	491	11	9·3	11·4
23	401	7	2·8	3·	57	404	6	8·4	10·
24	543	4	3·9	4·2	58	356	9	8·6	9·4
25	672	4	4·9	5·2	59	288	6	8·1	8·1
26	799	11	5·9	6·3	60	239	7	8·	7·3
27	970	14	7·5	7·8	61	206	8	7·4	6·7
28	1,154	15	10·	9·4	62	163	4	6·1	5·7
29	1,288	12	12·7	10·7	63	144	1	5·5	5·4
30	1,480	10	15·	12·5	64	128	..	5·1	5·2
31	1,627	14	16·6	14·	65	101	4	4·2	4·5
32	1,794	16	18·2	15·7	66	88	4	3·7	4·2
33	1,968	15	19·8	17·6	67	72	5	3·2	3·7
34	2,027	22	20·6	18·4	68	52	3	2·4	2·9
35	2,110	23	21·6	19·6	69	37	..	1·8	2·2
36	2,194	25	23·1	20·8	70	32	2	1·7	2·1
37	2,216	20	24·1	21·5	71	27	2	1·6	1·9
38	2,211	20	24·7	21·9	72	23	2	1·6	1·7
39	2,115	23	25·1	21·4	73	9	..	·7	·7
40	2,102	12	27·3	21·8	74	5	..	·5	·4
41	1,990	24	27·4	21·1	75	3	..	·3	·3
42	1,869	12	26·9	20·4	76	2	..	·2	·2
43	1,765	26	25·7	19·9	77	2	..	·2	·2
44	1,674	18	24·8	19·6	78	1	..	·1	·1
45	1,571	14	23·3	19·2	79	1	..	·1	·1
46	1,415	9	21·	18·2					
47	1,293	15	18·9	17·5		49,682	566	645·9	602·8

As a contribution to the statistics of life assurance, and promise of what is to come, this table deserves attention; but the Report exhibiting the experience of the Mutual Life Insurance Company of New York, though only for 15 years, comprises numerous facts of more varied interest and importance. It extends to February 1st, 1858, and was printed by order of the Board of Trustees. It is prefaced by a letter of the President, F. S. Win-

ston, Esq., to the Board of Trustees, in which he briefly recapitulates the circumstances under which it was prepared—paying a just compliment to the talents and scientific knowledge of Professor Gill, their former actuary, and to the great ability which Mr. Sheppard Homans, their present actuary, has shown in treating of the important questions suggested by the experience of the Company—and touches, with a thorough acquaintance with the subject, on the value of such contributions to science, and the effects they produce. On assuming his official duties, he had applied to other Companies to unite with this Society in gathering from public sources, from local agents and examining physicians in different sections of the country, such facts as might be useful to all; but he regretted to find that no response was made to this appeal, and that the *Report on Vital Statistics*, which was presented to their Board of Trustees by Dr. Wynne, was from data exclusively collected and furnished by their own Company. During the past two years, a further attempt to obtain the experience of other Companies with special reference to “term policies” has also failed. With these facts stated, we cannot but applaud the liberality and public spirit of the trustees in publishing data collected at so much cost and labour, and which will benefit those who have contributed nothing in return. The previous Reports on the mortality observed in the Company comprised the first 10 years of its history, and were brought down to the date of their second declaration of bonus, on the 1st of February, 1853, by Professor Gill, who was a Fellow of this Institute, and visited this country with the view of becoming acquainted with the members of our profession, and gathering practical information as to the state of the science and practice of the business here. His Reports were the first attempts made in the United States to ascertain the effects of climate in the different regions of that vast country. They will be found at length in vol. iii., p. 300, of the *Assurance Magazine*, and I will therefore only briefly recapitulate his conclusions as they bear upon the more complete and recent Report of Mr. Sheppard Homans. The whole of the members of the Company were divided into five classes, according to their residence in localities more or less healthy. In Classes I. and II., comprising the eastern and middle States, and west of the middle States north of the southern line of Virginia and Kentucky, he recommended no increase of premium, as Class II., though up to that time showing a mortality somewhat in excess, was favoured by causes likely to ameliorate it. In Class III., which comprised the States south of the preceding

line and north of the 32nd parallel of latitude, which was charged $\frac{1}{4}$ per cent. extra, his calculations showed that $\frac{3}{4}$ per cent. extra on the sum assured would be required to meet the real risk. The mortality in Class IV., including the States south of the 32nd parallel of latitude, showed a mortality of more than 50 per cent. greater than Classes I. and II.; and whereas they were then charged $\frac{1}{2}$ per cent. extra, the real rate ought to be $1\frac{1}{2}$ per cent. But in Class V., which included the then unsettled districts of California, the mortality had been so excessive—four and a half times greater than that of Classes I. and II., and requiring an extra premium of 13 per cent.—that he could only come to the resolution of advising that risks should not be undertaken there at all. Another remarkable circumstance observed, was, the excessive mortality at the older ages of the general experience of the Company. Whereas, between ages 35 and 55, the mortality in Classes I. and II. was even less than in the first year of the English “Experience of seventeen Offices,” between 35 and 65, it was nearly to their whole experience, and above 65, nearly twice as great. Suspecting that the marked change in the rate of mortality, which occurs in Europe at or about the age of 55, may proceed from some hidden causes which act with still greater intensity in the United States, Professor Gill suggested that at the next State census particular attention should be paid to this point, with the view of eliciting, if possible, the secret of the increase. In the meantime, he advised that no lives should be assured above 55.

The second Report of Professor Gill brought the preceding accounts down to the termination of 10 years’ experience and the period of the second division of profits of the Company. It indicated a general improvement in all the classes except Class IV., and a very perceptible change for the better in Class V.

Mr. Homans’ continuation of these valuable Reports is marked by great scientific skill and ability, and by a thorough knowledge of the theory of life tables and of the points that will occur in the practice of life assurance. His Report is illustrated by diagrams and comparisons with European tables, and is in every way honourable to himself and to the Company with which he is connected. The members of the Company are still divided into the same classes as in the earlier Reports, according to the character of the climate of the States in which they reside; and the observations have been further distinguished into the mortality exhibited by short period policies, and according to the ages in each class. The age taken is the Office age, which (different from the practice which prevails

here of taking the age always as at last birthday) is charged for according to the rate of the nearest birthday, last or next. The Office age, therefore, on the average, very nearly corresponds to the true age at the date of admission. The lives have been carefully separated from the policies, so that every precaution appears to have been taken to ensure accuracy of results, and the probable and actual losses on the sums assured have been compared. The total from 1842 to 1857 shows 68,618 lives as passing through one year, at different ages; the amount assured on which, estimated as for one year, was 211,059,018 dollars, or about £2,814,120 sterling for each year of the Company's existence. The actual losses were 750 lives assured for 2,312,545 dollars, whilst the probable loss by their own Office table would be 914 lives for 2,882,633 dollars, and, by the Carlisle Table, 857 lives for 2,692,464 dollars. This statement comprises, of course, all the worst as well as the best climates—California as well as New England; and it is remarkable that, under such circumstances, the result of 15 years' experience should show claims to the extent of only 80 per cent. of their assumed table, or 90 per cent. of what would be estimated as probable by the Carlisle Table.

The summary for each year is given, but as we have rather to deal with the *law of mortality* amongst assured lives, I pass on to the table which Mr. Homans has given of the number of lives exposed to risk at each age, and the mortality observed therein. The following is a record of the actual facts, and the estimated mortality by the Carlisle Table, which I prefer, for comparison, to the Company's own theoretical table, as being better known in this country. I have also omitted the comparison of losses on sums assured, as being more of special than public interest, and depending to a certain extent on the nature and regulations of the business. (*See Table, next page.*)

Before proceeding to the examination of the table, it will be advisable to describe the classes in which the members have been arranged, and afterwards compare all the results together. The different States combined in each class are indicated in a map which accompanies the *Fifteenth Annual Report of 1858*.

Class I. comprises the New England States, New York, Pennsylvania, New Jersey, Delaware, Maryland, and part of Virginia.

Class II.—Michigan, Wisconsin, Iowa, Illinois, Indiana, Ohio, Missouri, Kentucky, and part of Arkansas and Tennessee.

The best experience of the Company has been in the city of New York, where the lives proposed have passed the examination

Table showing the Actual Mortality by the Experience of the Mutual Life Insurance Company of New York, for Fifteen Years, compared with the Probable Mortality by the Carlisle Table.

Age.	Lives exposed to Risk.	Actual Deaths.	Probable Deaths by Carlisle Table.	Age.	Lives exposed to Risk.	Actual Deaths.	Probable Deaths by Carlisle Table.
14	22	..	·1	47	1,695	20	24·8
15	39	..	·2	48	1,535	23	21·4
16	42	..	·3	49	1,405	18	19·2
17	55	..	·4	50	1,243	15	16·7
18	62	..	·4	51	1,090	17	15·6
19	109	4	·8	52	949	12	14·4
20	173	1	1·2	53	823	15	13·3
21	272	4	1·8	54	727	16	12·3
22	396	5	2·8	55	622	12	11·1
23	597	4	4·2	56	543	13	10·3
24	806	10	5·7	57	448	9	9·4
25	1,046	11	7·7	58	371	6	9·0
26	1,290	11	9·5	59	312	3	8·7
27	1,590	8	12·4	60	259	7	8·7
28	1,878	11	16·3	61	213	12	7·6
29	2,069	20	20·3	62	167	5	6·3
30	2,313	26	23·4	63	132	9	5·0
31	2,503	21	25·5	64	105	5	4·2
32	2,701	31	27·4	65	86	5	3·5
33	2,812	26	28·3	66	67	3	2·9
34	2,995	35	30·4	67	50	1	2·2
35	3,021	29	31·0	68	35	1	1·6
36	3,050	35	32·1	69	27	1	1·3
37	3,068	23	33·2	70	20	1	1·0
38	3,050	30	34·1	71	13	..	·7
39	2,968	31	35·2	72	12	1	·8
40	2,843	13	37·1	73	7	..	·5
41	2,687	21	37·0	74	7	1	·6
42	2,551	21	36·7	75	4	..	·4
43	2,408	28	35·1	76	4	..	·4
44	2,255	23	33·4	77	3	..	·3
45	2,078	21	30·8	78	1	1	·2
46	1,899	15	28·1		68,618	750	857·3

of their own medical officers, and the next best in the territory embraced by this and the New England States. The experience of the remaining part of Class I., and the whole of the States comprised in Class II., have been quite similar in the proportion of losses. No extra premiums are charged for these two classes.

Class III.—Georgia, North and South Carolina, or southern States bordering on the Atlantic. The mortality has diminished in the last five years, and has resulted favourably for the Company with the increased extra rates charged since 1854.

Class IV.—Texas, Mississippi, Alabama, Florida, Louisiana, or southern States bordering on the Gulf of Mexico. The mortality has materially increased in the last five years, and to an extent

somewhat alarming. The extra rate charged for the first 10 years was found to be inadequate, and in 1854 it was advanced from $\frac{1}{2}$ to 2 per cent., and on unacclimated risks from 2 to 5 per cent. extra. The present rates are not supposed to be too heavy; and as other Companies still maintain the old rates, they do but little business in this class.

Class V.—The western territories and California. The rate of mortality here has shown a great improvement—no doubt, arising from the increased facilities in procuring the comforts and necessities of life in that newly-settled country. The climate is believed to be excellent; and though the first 10 years of the Company showed a heavy loss (the actual deaths being 419 to every 100 predicted), yet the last five have scarcely exceeded the mortality expected, and a hope is expressed that the time may soon come when the extra rate will bear reduction.

Class VI.—The Mississippi Valley, within 10 miles of the Mississippi and Missouri rivers, north of 36 degrees. This class has been recently formed out of Class II., and comprises only the immediate vicinity of these rivers, where a charge of $\frac{1}{4}$ per cent. extra, believed to be sufficient, is made.

Class VII. embraces risks in various foreign countries, but principally sea risks in the naval and merchant services. Since taking off the extra rate charged for sea risks between America and Europe, several losses have occurred amongst the assured who were on board steamers or sailing vessels, and it is doubtful whether it was expedient to take off the extra risk formerly required in these cases.

Considering that the assured reside in all parts of the United States, under such varied conditions of climate and manner of life, the following table, showing the actual and probable mortality in each class—the first ten compared with the last five years of the Company's experience—becomes of great interest. (*See next page.*)

In addition to the observations before made on the nature of this table, it is worthy of remark, that in Class IV., in which the proportion of actual to predicted deaths has greatly increased in the last five years, the proportion of money loss has been even greater still—208,500 dollars having been paid where only 119,209 dollars were expected as claims. It seems to me to demand an inquiry into the motives for assurance as well as into the risks of climate.

		Lives exposed to Risk for a whole Year.	Deaths.	Actual Mortality per Cent.	Probable Mortality per Cent.	Percentage of Actual on Probable Deaths.	Actual Money Loss to every 100 dollars predicted.
Whole Company.	1843-52	31,432	340	1.08	1.28	84.8	77.7
	1853-57	37,186	410	1.10	1.33	79.9	82.1
	15 years	68,618	750	1.09	1.33	82.	80.2
Class I.	1843-52	19,937	178	.89	1.28	69.8	69.9
	1853-57	26,640	262	.98	1.39	71.1	
	15 years	46,577	440	.96	1.34	70.5	
Class II. (inc. VI.)	1843-52	4,479	48	1.07	1.26	84.7	87.2
	1853-57	6,394	79	1.23	1.33	92.9	
	15 years	10,873	127	1.17	1.30	89.7	
Class III.	1843-52	1,570	20	1.27	1.29	99.	98.9
	1853-57	1,555	21	1.35	1.46	92.6	
	15 years	3,125	41	1.31	1.37	95.6	
Class IV.	1843-52	1,441	23	1.24	1.29	123.8	174.9
	1853-57	1,638	35	2.14	1.46	146.2	
	15 years	3,079	58	1.88	1.38	136.4	
Class V. (inc. VII.)	1843-52	861	37	4.30	1.03	418.7	69.4
	1853-57	960	13	1.35	1.34	101.2	
	15 years	1,821	50	2.75	1.19	230.6	

In order to show in a very clear way the practical use of this table to the Company, Mr. Homans has calculated the rate of extra premium per cent. on the amount of assurance which ought to be demanded in order to place the members of the different classes on the same footing as Class I., or Classes I. and II. combined.

	With Class I.	With Classes I. and II. combined.	Extra Premium now charged per Cent. on Sum Assured.
Class II.	0.745	..	..
" III.	1.147	0.975	0.5
" IV.	2.867	2.634	2.0
" V.	5.449	5.158	1.0
Ditto, from 1853.	1.290	1.092	1.0

Several applications have been made from the southern agencies to have the extra premiums reduced; but it is evident, from the above results, that they have been judiciously laid on, that in no case do they equal the actual extra risks incurred, and that, in justice to the large majority of members who reside in the New England and Middle States, they can neither be rescinded nor reduced.

The next interesting question is as to the relative mortality amongst persons assured for short periods or the whole of life; and

the last Report suggested that the issue of term policies at the rates hitherto charged is not advisable, as the mortality greatly exceeds that deemed probable by their own tables, or by the tables of English Companies. The attempt to combine the experience of other American Companies in this respect failed, but the following are the facts resulting from their own :—

	Number of Lives.	Deaths.	Per Cent. of Probable Deaths.	Actual Rate of Mortality.	Probable Rate of Mortality.	Extra Premium to be charged.
Whole life	33,222	341	74	1·02	1·39	..
Endowment	83	0	0	·0	1·60	..
Seven years	3,256	56	127	1·72	1·35	1·090
Other short terms .	625	13	168	2·08	1·24	1·378
Whole Company . .	37,186	410	80	1·10	1·38	

The mortality in short term policies has been found in all cases inversely proportionate to the length of the term of the policy itself. If an extra premium corresponding to the real risks were put on, it would vary from 1 to 2 per cent., and in most cases bring up the premium to the rate charged for the whole of life ; and, by a recent resolution, the Board have determined to decline undertaking such risks altogether.

I am not aware that any large collection of facts has been made in this country throwing light on this question. The general impression is, that as the benefit of selection is the greatest within a brief period after medical examinations, short term policies would be more profitable than others. Such policies, however, are more often effected by creditors or other parties having an interest in the lives assured, and who would probably run their own risk unless special circumstances made it peculiarly hazardous ; or they may be made by parties on their own lives, who, from family circumstances or history, dangerous occupation or otherwise, wish to protect themselves at the cheapest rate against what they deem unusual but temporary danger to life. Such motives, and the advantage the assured always has against the Office in the secret knowledge of his own constitution, family history or circumstances, may be more than a set-off against the vigilance or skill of the medical examiner. At any rate, I hope that the question brought to issue by the facts recorded by the experience of the American Company, may have some light thrown upon it by the still larger experience recorded in this country.

The comparative mortality of the Company at different ages is

shown in the following table, carefully adjusted by Mr. Homans from the experience of the 15 years, which he has compared at each age with the Company's (or Mr. Gill's) theoretical table, and given also the expectations of life by both tables at every age. I give the adjusted table, as it is the most authentic and complete table yet deduced from American assured lives, and will allow of any combinations and comparisons.

Adjusted Table of Mortality, according to the Experience of the Mutual Life Insurance Company of New York, for Fifteen Years ending 1st February, 1858.

Age.	Number Living.	Number Dying.	Mortality per Cent.	Age.	Number Living.	Number Dying.	Mortality per Cent.
10	100,000	741	·741	55	65,208	1,086	1·666
11	99,259	739	·744	56	64,122	1,131	1·764
12	98,520	738	·749	57	62,991	1,185	1·881
13	97,782	737	·754	58	61,806	1,247	2·017
14	97,045	736	·758	59	60,559	1,317	2·175
15	96,309	735	·763	60	59,242	1,399	2·361
16	95,574	734	·768	61	57,843	1,485	2·568
17	94,840	733	·773	62	56,358	1,578	2·800
18	94,107	732	·778	63	54,780	1,675	3·057
19	93,375	731	·783	64	53,105	1,774	3·340
20	92,644	732	·790	65	51,331	1,878	3·659
21	91,912	732	·796	66	49,453	1,978	4·
22	91,180	733	·804	67	47,475	2,082	4·386
23	90,447	733	·811	68	45,393	2,193	4·831
24	89,714	734	·818	69	43,200	2,304	5·333
25	88,980	735	·826	70	40,896	2,427	5·935
26	88,245	735	·833	71	38,469	2,539	6·601
27	87,510	736	·841	72	35,930	2,623	7·299
28	86,774	737	·849	73	33,307	2,730	8·197
29	86,037	738	·857	74	30,577	2,705	8·847
30	85,299	738	·866	75			
31	84,561	739	·874	76			
32	83,822	739	·882	77			
33	83,083	740	·891	78			
34	82,343	740	·899	79	17,669	2,298	..
35	81,603	740	·907	80			
36	80,863	740	·915	81			
37	80,123	738	·921	82			
38	79,385	736	·927	83			
39	78,649	732	·931	84	7,732	1,466	..
40	77,917	726	·932	85			
41	77,191	721	·934	86			
42	76,470	717	·938	87			
43	75,753	719	·949	88			
44	75,034	729	·972	89	2,156	630	..
45	74,305	750	1·010	90			
46	73,555	784	1·066	91			
47	72,771	824	1·133	92			
48	71,947	867	1·205	93			
49	71,080	908	1·277	94	213	110	..
50	70,172	941	1·341	95			
51	69,231	966	1·395	96			
52	68,265	990	1·451	97			
53	67,275	1,018	1·513	98			
54	66,257	1,049	1·583	99	1	1	100·

In order to show the experience of the Company as to mortality under ages, the following table represents the proportion per cent. of actual to predicted deaths in decennial periods of age; and a comparison is made with the Mutual Benefit, of which Mr. Homans has computed the results from the table contained in their Report, and which I have given in a previous part of this paper.

Percentage Proportion of Actual to Predicted Deaths.

Ages.	15-25.	25-35.	35-45.	45-55.	55-65.	65-75.	All Ages.
Class I. alone	90	77	61	66	98	71	71
Classes I. and II. combined	90	86	65	67	95	83	74
Class II. (including VI.)	89	127	80	71	83	195	90
Class III. alone	662	85	96	90	99	0	96
Class IV. alone	595	215	156	79	44	122	136
Class V. (including VII.)	431	337	159	201	0	0	231
Whole Company	145	99	73	73	89	80	82
Whole Company (of Carlisle Table)	157	99	74	88	101	92	88
Mutual Benefit	191	101	80	84	72	103	88

In Class I. alone, or in Classes I. and II. combined, it will be noticed that the mortality in the Company is less than was expected at all ages—the middle period of life, from 35 to 55, being the most favourable; but in Classes IV. and V., comprising the southern States of the Gulf of Mexico and California, the mortality at the younger ages has been of an extraordinary character.

From the diagrams given in the original Report, the curves of the mortality in this Company can be compared with those in Mr. Gill's former table, with Farr's English Life, the Carlisle, and the Actuaries' Table. The most remarkable feature is the great comparative value of life in the former between the ages of 30 and 60. Below 30, and especially below 25, the value of life rapidly becomes less than was anticipated by previous observations. The excessive mortality at the younger ages, which is not only observable in this Company, but still more in the Mutual Benefit of New Jersey, may arise from the early period at which young men in the United States enter upon the cares and excitement and anxieties of active business—when the passions of youth are still in full play, and steadiness of habits, that may be presumed to follow more mature age, not yet rendered permanent. If the results in all classes and in both Societies were not so uniform, I should be disposed to allow that the number of lives at the younger ages was not sufficient for a fair comparison.

The curve of the Company's general experience approaches more nearly to the Actuaries' Table, the "Experience of Seventeen

English Companies," than any other. On examining the curve representing the number out of which one will die in each year in Classes I. and II. combined, Mr. Homans observed in his table what has been before noticed in some English tables, viz., that two points of maxima were shown at ages 27 and 42, and two of minima at ages 24 and 34. The value of life, or chance of living, increases from 24 to 27, then decreases to 34, and then rapidly increases to age 42, and as rapidly decreases to the close of life. Mr. Finlaison noticed the same peculiarity in his Government Male Annuity Table (1829), in which the point of greatest security of life was at age 13, decreasing to age 23, then increasing to age 34, then decreasing slowly to age 48, and then rapidly diminishing to the close of life. M. Quetelet has confirmed the same observation in Belgium, and Mr. Neison has shown the same result in his "Tables of Friendly Societies Experience," the maxima and minima varying according to the different occupations of the members. The Mutual Benefit of New Jersey shows also two points—ages 31 and 40 maxima, aged 21 and 36 minima. The causes of such anomalies are not very clearly understood, but they are well worthy the attention of the actuaries of Life Assurance Companies who have access to materials the most complete in form and the most accurate in facts that can be referred to for elucidation.

The comparison of the mortality in England with that of the Northern United States of America may be made by assuming the tables of Mr. Kennedy or Mr. Elliott, and those of Dr. Farr, as sufficiently correct for the purposes to which a census may be applied. But a still more accurate, and, to English Companies, more important comparison, may be made by comparing the results of their own experience with that of American Companies. Accordingly, the following table from Mr. Homans' Report shows the mortality per cent., in decennial periods of age, of the two American Companies, and of a table deduced by Mr. Homans from the census of the State of New York, taken in 1855, which, however, must be received with the usual allowance for the difficulties in procuring a perfect census.

Ages.	Exp. Seventeen English Companies.	Mutual Life of New York, Classes I. and II.	Fifteen Years, Whole Company.	Mutual Benefit, Twelve Years.	New York State Census, 1855.
15-25	.	·68	1·10	1·34	·80
25-35	·79	·82	·94	·97	·77
35-45	1·10	·81	·91	1·00	1·04
45-55	1·61	1·18	1·28	1·24	1·47
55-65	2·94	2·73	2·55	1·85	2·10
65-75	5·18	4·53	4·34	4·93	4·08

As compared with the English Assurance Companies, the two American Companies show a lower rate of mortality at all ages after 35, and at the middle periods of life to a very great extent; but below 35 the rate in both these Companies is not only unfavourable when compared with the English, but it very greatly exceeds the rate of mortality indicated in the table constructed from the New York census. This latter table, it gives us some surprise to find, exhibits at all ages a less rate of mortality than even English assured lives.

The conjecture of Mr. Gill, that the older lives would be found subject to a higher mortality than in England, does not seem justified by any of these tables.

In order to complete the comparison, the following table places in juxtaposition the expectation of life by the experience of the Mutual Life of New York, and of all the English Companies whose experience has been published, and also Elliott's Massachusetts Tables compared with Dr. Farr's English Life Table, No. 1.

Expectation of Life.

Age.	Mutual Life of New York, Fifteen Years.	Actuaries', or Seventeen English Companies'.	Equitable.	Economic.	Amicable.	Eagle.	Massachusetts, 1855. Elliott.	Farr's English, No. 1.
20	42·8	41·5	41·1	41·4	..	38·5	39·9	39·9
30	36·	34·4	34·	34·8	33·7	32·2	34·	33·1
40	28·9	27·3	27·4	27·2	25·9	25·7	27·9	26·6
50	21·6	20·2	20·8	20·	19·	19·4	21·3	20·
60	14·6	13·8	15·1	13·8	12·9	13·6	15·	13·6
70	8·6	8·5	9·8	9·2	8·1	8·6	9·4	8·5

The adjusted table of the Mutual Life Assurance Company of New York gives a higher expectation of life at all ages than their own theoretical table, and higher at all ages than any of the English tables, except the Equitable at 60 and upwards, and the Economic at 70. The Massachusetts Table also shows a higher expectation of life at all ages than Farr's English Tables. We should be prepared to wait for further confirmation in both classes of facts—for the former, on account of the recent selection of lives, and for the latter, on account of the probable defects in the registration of the census, which most American writers seem willing to admit is only gradually approaching perfection.

Still, there is nothing in the facts recorded with so much minuteness and accuracy, and reasoned upon with so much skill and ability, in the Report of Mr. Homans, but what is highly

favourable to the cause of life assurance. The rates, though imperfectly adjusted at the different ages to the actual risks ascertained both by the experience of his own Company and of the Mutual Benefit of New Jersey, are yet amply sufficient on the whole to afford large profits; and it would be unwise to alter them, till further observations, made in the same careful and elaborate manner, lead to decisive and final results.

Whether English Companies carrying on operations in America can expect equal success, is to me problematical. It is natural to suppose, that native Companies of such magnitude must have the choice of the business, and will obtain the largest share of profits. If few Companies of position and character existed there, the reputation of the English Companies for capital, enterprise, and honourable dealing might make them formidable competitors; but seeing the serious and unexpected losses which we have noticed in the early history of some of the classes of the great American Company here referred to, they should at least feel their way with equal caution, and record their experience with equal care.

In any case, we can congratulate the Americans on their energetic extension of this business. In the State of New York alone there were, in 1857, ten American Life Assurance Companies, which issued in that year 7,004 new policies, for assuring 20,478,857 dollars, or about £4,096,000 sterling; and had at risk, at the end of the year, 40,508 policies for 110,024,014 dollars, or about £22,005,000 sterling; whilst their receipts for the year amounted to 3,965,600 dollars, or £793,000. This is the more remarkable, as the oldest of these Companies, the one whose experience we have been considering, had not been in existence more than 15 years, and yet in 1857 its new business was 1,863 policies for assuring £1,170,000, and its policies in force at the end of the year 10,390, assuring £6,090,000 sterling.

When the census of the United States was taken in 1790, the population was found to be under 4,000,000; at the present time it is computed to be 30,000,000. In a nation striding to greatness with a rapidity so unexampled as this, we may be prepared for an equally rapid development of all those institutions which attend the advance of refinement and knowledge; and amongst them it cannot but be gratifying to notice the progress of those with which we are more especially concerned, and which have been proved by experience to be alike an evidence of civilisation, a benefit to the public, and an honour to the age and country in which they most prevail.

*John De Witt; or, Twenty Years' Interregnum in the Stadtholdership of the Seventeenth Century.*¹ By M. ESQUIROU DE PARIEU, Vice-President of the Imperial Council of State, Member of the Institute of France, &c. &c. (Translated by Frederick Hendriks, Esq., Actuary of the Globe Insurance Company.)

[Read before the Academy of Moral and Political Sciences, Session 1858.]

THE history of the United Provinces, and of Holland especially, from the close of the Spanish rule down to the establishment of the modern monarchy of the Netherlands, is distinguished for its manifestation of a permanent struggle between different opposite principles. Liberty and authority, municipal principle and state principle, republic and monarchy, the spirit of federal isolation and that of centralization, appear to give battle to each other upon a territory itself with difficulty defended from the waves of the ocean by the watchful industry of its inhabitants.

The municipal element, appears, nevertheless, as the primitive kernel of Dutch society. "The towns of Holland," says a modern historian,² "were not, like those of other nations, mere sections of the State, for the State itself was rather an aggregation of towns, each of which constituted a distinct republic, providing for its separate defence, governed by its own laws, having its separate courts of justice and separate financial administration. The legislative sovereignty of the whole nation vested in the cities, which formed, in their collective capacity, the assembly of the States."

The internal administration of these towns was composed of a senate; of two, three, or four burgomasters, constituting what was called the *Wethouderschap*; and of a certain number of *échevins*, or sheriffs, who exercised judicial power. The *schout*, or bailiff, represented the authority of the count.

The burgomasters and sheriffs were nominated by the grand council of the town (*Vroedschap*). The composition of this grand council varied much in the different towns. At Hoorn, the grand council comprised all the inhabitants worth a capital of 250 nobles; at Dordrecht it only consisted of life members, who were recruited by election. In the constitution of this town, which was the most aristocratic of any in Holland, there was but one burgomaster, nominated annually.³

¹ It is known that there was, in the eighteenth century, a second interruption of the stadtholdership, from 1702 to 1747.

² Davies: *History of Holland*, vol. i., p. 76, *et seq.*; Analysis of the Dutch Constitution prior to 1579.

³ This internal organization of the towns of Holland is not without analogy with the

There were, however, to be found in the States of the Netherlands Provinces, besides the town deputies, certain deputies of the nobility, or *ridderschap*. But this equestrian order, the name of which reminds us of that which still exists in Prussia,¹ does not seem to have ever played either a very considerable or distinct part in the affairs of the United Provinces.

The same remark applies to the ecclesiastical order. In Holland and Overijssel, the clergy had never figured in the States. It had been represented, in Zealand, by the abbot of Saint Nicholas; in Brabant,² by the fourteen abbots; at Utrecht, by the five chapters.³

The States of the Provinces had no functionaries, properly so called, unless we except a secretary and a pensionary. Nevertheless, their power was considerable; "And thus these provinces," says Meteren, "have been in all times (when they had no competent lords or princes, or only such as were still minors or uninaugurated) governed by the said States. So much so, that we may term their government *aristocratie* or *puissance de peu de gens*; for although their sovereigns—governing well, and according to their privileges—had such authority that they could do as they would, provided they did well, nevertheless, if they were governing ill, the States had their eye upon them, to keep them in check; and the common people, who consisted of trades and confraternities, and were governed by their wardens, looked after the States; and this is the reason why some call this government a mixed government."⁴

The influence of the House of Orange, and of the continuity of offices which had been delegated to it, since the time when William I. had been declared, in 1576, admiral and stadtholder of Holland, Zealand, and other places,⁵ gradually modified the political constitution of the United Provinces. This House of Nassau, which produced a remarkable succession of able princes, devoted to their country, at length arrived at the possession,

existence of large and small councils in the organization of the Swiss towns. The instructive work of M. Cherbuliez, *La Démocratie en Suisse*, may be advantageously consulted on this head.

¹ *Ritterschaft, rittergut*.

² In 1609, Brabant was divided between the United Provinces and the Spanish Netherlands.

³ See Davies, vol. i., p. 85. Emanuel de Meteren: *Histoire des Pays Bas, traduit du Flamand*; La Haye, 1618.

⁴ Mr. Davies attributes to the example of Holland the first ideas of civil and religious liberty introduced into England (vol. i., p. 1). Harington, according to Toland, used to say that he had learnt in Holland the sense of the fundamental maxims of political science.

⁵ Kerroux: *Abrégé de l'Histoire de Holland*, p. 322. See also *ibid.*, p. 348.

through its several branches, of the stadtholdership, or executive power, of the seven United Provinces.¹ The government of these provinces, remaining republican in name, inclined in reality more and more towards monarchy. The commercial spirit of the towns, legitimately represented by the States, struggled, however, against the development of the power of the stadtholdership, and kept up, in Holland especially, the republican principle. Families which had long been invested with local magistracies, liked to be conservative of the institutions of a peaceful, economical government, that allowed, through its forms, the preservation of their influence. But the military, the ministers of the reformed religion (whom the republican party strictly confined to their ecclesiastical functions,² and whom the House of Nassau knew how to attach to its cause³), the landed nobility of the eastern provinces, and the section of the people which was excluded from any participation in the municipal government, emulated each other in supporting the power of a family which, by its alliances with the dynasties of Europe, augmented the prestige it had based upon the services it had rendered to the cause of national and religious independence. The rivalries of the federal Government, also, gave other supports to the House of Orange.

The province of Holland exercised a specially preponderating influence in the confederation of the United Provinces. Paying, of itself alone, 57 per cent. of the common charges, and receiving the deputies of the other provinces upon its territory, Holland was, to borrow a common expression in the Swiss Confederation, a kind of permanent *vorort*, the influence of which was such that the great deeds worked out by the United Provinces are frequently confounded, in the recollections and appreciations of history, with the acts of Holland singly. The advocate, or pensionary-councillor, of Holland, was, even from the necessities of his post, called to play an important part in the States-General, where he had to take a place in the name of his province.⁴

¹ "Maurice, stadtholder of Holland and of Zealand, had obtained, in addition, the stadtholdership of Guelderland, Utrecht, and Overysse, in 1591, after the decease of the Count de Nieuenaar" (Kerroux, p. 385). "The stadtholdership of Friesland, and that of Groningen, were customarily held, in the seventeenth century, by another branch of the House of Nassau. Nevertheless, it appears that Frederick Henry and William II. were invested with the stadtholdership of Groningen" (Kerroux, pp. 590 and 599).

² Emmanuel Van der Hoeven: *Leven en Dood van Cornelis en Johan De Witt*, t. ii., p. 17; Amsterdam, 1708.

³ "The devotion of the ministers of religion to the House of Orange had declared itself from the days of Maurice" (Kerroux, p. 429).

⁴ See articles 25 and 21 of the *Instructions for the Post of Pensionary-Councillor*, at two different epochs, quoted textually by Van der Hoeven, t. i., pp. 17 and 112. In terms of the 1st article of the second of these instructions, the pensionary-councillor had

As Holland, from its riches, its population, and the importance of its cities, was the natural centre of commercial and republican policy in the United Provinces, it was not astonishing that the provinces which struggled against its preponderance should attach themselves to Orangeism as well as to the more natural counterpoise of the influence of Holland; and, on the other side, it was easy to understand that Holland should strive to weaken a federal bond which denied to its vote, in general affairs, a weight *legally* superior to that of the vote of the other provinces confederated with her. "This special interest," says M. Thorbecke, in giving an account of the work of M. Simons on John De Witt, and in touching upon the state of debate after the death of William II., "overtopped the question of the reinstalment of the princes of Orange in their general and provincial functions—a question usually placed in the first rank, because it is common to confound later periods with those which now occupy us."

Such were the chief elements of disagreement in a political organization full of energy and full of incoherency, and as replete with vitality as with irregularity.

Elective by right, hereditary by fact, the domination of the House of Orange must have experienced, more sensitively than a genuine dynasty, the inconveniences of the interruption which troubles every reigning family on the occurrence of minorities.

In the middle of the seventeenth century, a minority without a possible regency, since the stadtholdership was then an elective personal and annual post, coincided with the advent to administrations of an eminent minister of Holland, and also with a sufficiently active reaction against the encroachments of the last stadtholder. This episode, which has been often, but briefly, treated upon in our historical literature,¹ offers, perhaps, a particular interest to the men of our own time, who, in circumstances immensely different, have, nevertheless, also seen, like the Hollanders of the seventeenth century, republican ideas and monarchical ideas struggling against each other in their own country, and who have with their own eyes, or by the testimony of recent history, assisted several times in France in the waking-up of the principle of political heirship arising from revolutionary attempts and agitations, and being born again, so to speak, from its ashes.

William II., the third successor of William the Taciturn in

to be acquainted at least with the Latin and French languages, and to belong to the reformed religion. See, also, the German translation of the work of Simons upon *John De Witt and his Times*, t. i., pp. 31, 221, 228, et seq.

¹ See the article by M. Mignet in *Revue des Deux Mondes*, 1841.

the stadtholdership, had, in 1647, replaced his father, Frederick Henry; and, from the very beginning of his power, had seemed to draw from his marriage with Mary Stuart, of England, the moving spring of an ambition partaking in some measure of a *sovereign* character.

On the 3rd July, 1650, vexed by the intention of the States of Holland to send back a large part of the army, and irritated especially against certain towns which had badly received him in an excursion he had made to obtain from them the repudiation of the opposition from the States, he resolved to summon before him, and to arrest in his room, six members of the States who were opposed to his policy and belonged to localities of which he thought he had reason to complain.

These were James De Witt, ex-burgomaster of Dordrecht; John De Waal, burgomaster, and Albert Ruyl, pensionary of Haarlem; John Duyst Van Voorhout, burgomaster of Delft; Keyzer, pensionary of Hoorn; and Nicholas Stellingwerf, pensionary of Medenblick. They were conducted to the fortress of Louvenstein, already sadly known through the incarceration of Hogerbeets and of Grotius, under the stadtholdership of Maurice; and they only went out of it, some months subsequently, upon resignation of their offices.¹

James De Witt, who belonged to a family of the burgher aristocracy of Dordrecht,² seems to have played some part, not only in home affairs, but probably also in foreign negotiations interesting his country; and one of his relations, Andrew De Witt, was for some time advocate of Holland, after the imprisonment of Barneveldt.³ He had two sons, destined to represent with honour the party which had received a blow in his person, and in the minds of whom he had probably nourished from infancy the excitement of his own resentment.⁴

Cornelius De Witt was born on the 15th June, 1623; and John De Witt on the 17th September, 1625. The latter, remarkable from his infancy for precocious talent and deep scientific study, completed his education by voyages abroad, and by the apprenticeship of the bar.⁵ He was successively appointed, in 1650,

¹ Davies, t. i., pp. 526 and 691.

² The particle "*de*," in Dutch, corresponds with our article "*le*"; and "*van*" with our particle "*de*."

³ See what is said of the journey of James De Witt in Sweden, and of the relations which he had at Lubeck with the ambassador of France, Chanut, in the *Recueil des Lettres de Négotiations de Jean De Witt*, French translation, t. i., pp. 120 and 343. Van Hall: *Lofrede of De Witt*, p. 57.

⁴ "Remember," said he to them, "the prison of Louvenstein!" (Kerroux, p. 655.)

⁵ Van Hall: *Lofrede of De Witt*, pp. 59 and 70.

pensionary of the town of Dordrecht, and, in 1653, after the decease of Adrian Paauw, Seigneur de Heemstede, pensionary-councillor of Holland.¹ He was invested, when 28 years old, with that kind of tribuneship which had cost Barneveldt his life, and which the predecessor of Paauw, James Cats, had relinquished with tears of joy, kneeling in the midst of the Assembly of the States, to thank heaven aloud at going out of office without misfortune.²

No one had contested John De Witt's election, "on account of the perilous present time," writes a contemporary.³

The stadtholder, William II., had died a little after the arrest of the six deputies of the States, leaving a posthumous son, the celebrated William III., born 4th November, 1650, one week after the death of his father. William Frederick, cousin of the young prince, stadtholder of Friesland and Groningen,⁴ not being accepted in the same capacity by the five other provinces, the stadtholdership was there in reality vacant.

In a constitution where power was almost continually balanced between the stadtholder and the pensionary-councillor of Holland—the latter filling to a certain extent the part of the accustomed leader of the States of this province, and often also of the States-General—such a position enveloped the germ of a decisive and almost sovereign influence on the part of the pensionary-councillor, and on that of the province he represented. Thus one sees, after the death of William II., the States of Holland immediately laying hands on great authority. They urged a meeting at the Hague of a great assembly of delegates from all the provinces—an assemblage which settled several questions, raised by the absence of the stadtholder, relating to differences between the different provinces, to religion and to the militia.⁵ So far as related to the internal administration of their provinces, the States of Holland allotted to themselves, or conferred upon the towns, the nomination to various employments previously entrusted to the stadtholder.⁶

A sort of interregnum began. What gives to this historical interval a special interest is, that it is entirely filled with the

¹ Emmanuel Van der Hoeven, t. i., p. 14. We say "pensionary-councillor," and not "pensionary of the council"; following a very pertinent note, as it seems to us, of the German translator of the work of M. Simons, part i., p. 221.

² Cats was a poet surnamed the Dutch La Fontaine.

³ Thurloe, vol i., p. 359.

⁴ The stadtholdership of Groningen, with which Maurice, Frederick Henry, and William II. had been invested (Kerroux, pp. 529, 590, and 599), was reunited with that of Friesland, after the death of William II., in the person of William Frederick (Kerroux, p. 631). They both passed to his son Henry Casimir, in 1664 (Kerroux, p. 718). The grandson of the latter joined the stadtholdership of Guelderland to the other two, in 1722, and became stadtholder-general of the seven provinces in 1747.

⁵ Davies, pp. 700 to 707.

⁶ *Ibid.*, p. 696.

history of one man. The pensionary-councillor, John De Witt, re-elected quinquennially in that capacity from 1653 down to his death, thus personified, until 1672, the semi-republican government of which he was the chief; and the transient character of which was attested by this very personification, which identified it, so to speak, with the skill and the position of a single man.

External events seemed to favour the development of the power of John De Witt.

The head of the king of England, Charles I., had fallen upon the scaffold of Whitehall, 30th January, 1649. The prince of Orange was, through his mother, the grandson of the sovereign immolated by the revolutionary passions which agitated Great Britain. He had received in his cradle, in 1653, the ribbon of the garter, which had been conferred on him by his uncle, Charles II., a Pretender, exiled upon the continent. The policy of republican England was interested that the stadtholdership should not be aggrandized for the profit of Charles's nephew in the republic of the United Provinces.

Already the coldness of the Dutch towards the Commonwealth of England, the bad reception given to the British ambassadors by the Orange party,¹ the exigencies of Puritan passion, which desired to force upon the two republics a union opposed by the diversity of the interests, the traditions, and the nationalities of these two countries, had lit up, in 1652, a disastrous war, in which De Witt, upon his accession to power, found his country engaged.

When the sufferings of the United Provinces, after a glorious resistance, made them seek that peace which was concluded by the treaty of Westminster, 15th April, 1654, Cromwell profited by the circumstance to lower, as much as depended upon him, in the United Provinces, the power of a house allied with that of the Stuarts, and whose active and persevering party skilfully made use of all the occurrences, and profited from the enmities, of the struggle²—as, later on, when Holland was at war with Charles II., this same party, we advance, from that moment knew how to work to its own profit the desire for peace.

The Act of Exclusion of the 4th May, 1654, voted by the province of Holland alone, on the demand of Cromwell, and as a condition of the peace previously signed, decreed that the young prince of Orange should be for ever shut out from the posts of stadtholder and of captain-general and admiral. The violation of

¹ Walter Harris, p. 2. Van der Hoeven, t. i., pp. 29 to 32.

² Davies, p. 721.

the federal constitution, by this treaty of an isolated province with a foreign power; the injustice of an exclusion thus declared, to the prejudice of an infant of four years old; the imprudence of this engagement in the face of a party of English royalists; and, finally, the renunciation by this interdict of a part of the national sovereignty, have naturally been made a subject of reproach against De Witt, but can only be really laid to his charge so far as relates to a share of the responsibility, which is difficult to determine, and, perhaps, does not even exist. The initiative of this requirement belonged, in point of fact, to Cromwell; and Holland, when she agreed to it, had suffered considerably from war. She had lost her great seaman, Martin Tromp. Three thousand houses, it is said, had become empty at Amsterdam.¹ Nevertheless, if nothing proves that De Witt wished for the Act of Exclusion—if it even appears that he sought to avoid it or to modify its terms²—the foundation of this Act was in agreement with the inner leaning of his policy; and when, after the fall of the Cromwell family, which took place in 1659, the cancelment of the clause of exclusion had been carried out, in 1662, in accordance with Charles II.,³ it was only to be very soon replaced; and in 1667, by an Act having the same purview and the same object—namely, the perpetual edict—which, as a spontaneous act of sovereignty on the part of the province of Holland, abolished for ever the stadtholdership, and thus sapped, at its base, the future of the young prince of Orange.

Whilst the policy of Holland was developing itself in the direction of a lessening of the power of the House of Orange, it is interesting to observe the pertinacity and life of the sympathies which surrounded the young collateral offshoot of the *father of his country*.

The heir, under age, of the prince of Orange, had none of the prerogatives of a sovereign. He was, however, of much higher consideration than the heir of a great citizen; and it is interesting to notice how many sentiments of hope and respect already surrounded the cradle of this child, who had for godfathers the States of Holland and Zealand, as well as the towns of Delft, Leyden, and Amsterdam, and whose predecessor had himself been invested, in 1631, and at the age of only 5 years, with the reversionary succession to the great offices of his father.⁴ In June, 1653, the

¹ Kerroux, p. 662.

² See his correspondence with Boreel, in the *Lettres et Négotiations*, t. i., pp. 129, 142, 120. On the other side, see the passage in *d'Estrades*, quoted by Kerroux, p. 704.

³ German translation of Simons, t. i., p. 97.

⁴ Kerroux, p. 569.

young William, then aged under 3 years, was taken to Bréda, and passed, in a boat upon the Meuse, before the town of Dordrecht. His nurse lifted him up in her arms to show to the people along the river shore. Many followed, crying "Long live the young prince!" and at night there was great excitement in the town.¹ Shortly after, on the 6th of August of the same year, the arrival of the young prince at the Hague also made a lively impression on the public opinion.² About the same period, certain provinces—Friesland, Zealand, and Groningen—demanded that the young prince should be invested with the offices of captain and admiral-general, upon the supposition that the count of Nassau, stadtholder of Friesland and Groningen, would administer them in his name.³ Three years later, the States of Holland were uneasy at receiving a petition in which the young prince, then aged only 6 years, was styled by the title of "his Highness," without any other addition. The States wished, through a rather puerile distinction, that the preamble of Acts done in the name of the young prince should bear these words—"M. the Prince of Orange;" and that the title of "Highness" should only be made use of in the body of the Act, and subordinate, as it were, to the preceding designation.⁴

Such was the state of mind in Holland at the beginning of John De Witt's government. The republican party was dominant in the country, but from an accidental and transient reason. Uneasy and uncertain before the cradle of a child whose name had remained popular, it aspired rather to keep within bounds, than to suppress, the influence of the House of Orange.

We do not here discover anything of that which characterised the political discords of England in the seventeenth century and of France in the eighteenth century. Doubtless, we must attribute this to the fact of political discussion being free, in Holland, from those questions of religion which were mixed up, to a very unequal extent, in the struggles just alluded to; and also to the circumstance of democratic agitation having had quite another object in that country. If a few military men or courtiers were there interested in the existence of the stadtholdership, the municipal and

¹ Van der Hoeven, i., p. 41.

² Kerroux, p. 671. The letter inserted in Thurloe's *State Papers* (i. p. 391) has reference to this incident. It relates that the house of John De Witt was nearly being pillaged, and that the windows of it were broken by the mob,

³ Thorbecke, *loco citato*.

⁴ Van der Hoeven, i. p. 87. The title of "Highness" was given, for the first time, to Frederick Henry, by the king of France. The stadtholder had previously only borne the title of "Excellency" (Kerroux, p. 581).

trading aristocracy obtained, on the other hand, an advantage in support of their own party from its suppression. The republican party was not popular in Holland, and it did not possess the attractions to which the sympathies of the masses sometimes give birth.

As to the religious question, there was nothing, in the United Provinces, during the second half of the seventeenth century, at all analogous to the ecclesiastical dissensions which gave play to passion in Great Britain towards the same period. If a religious dissent did serve as a pretext for the death of Barneveldt—if even the ministers of the State religion showed themselves in general favourable to the descendants of the founder of national and protestant independence, the division of theological opinions in Holland, in the time of John De Witt, had no longer the importance which is needful to arouse or give excuse for acts of violence.

It was natural, under these circumstances, that the popular sentiment should not second, in any respect, the republican innovation inaugurated around the cradle of an orphan; but it happened, rather under special events, that sedition furthered the cause of Orangeism against the municipal oligarchies; and, on another side, the moderate and lukewarm republicanism of the Dutch burghers found successively as little sympathy from the English of the revolution as from the restored Stuarts.

After having noticed the relations between Netherlandish Orangeism and republicanism, it is curious to observe how the fate of the two opposite political principles is bound up with the events embraced in the government of John De Witt, and which seem to divide themselves into three principal periods—before, during, and after, the war against Charles II., which occupies the intermediate epoch.

The history of John De Witt, during these various epochs, presents itself under two aspects, which are distinct, although mutually connected. In following the diplomatic, administrative, and military events which took place under the government of the pensionary-councillor, we must never lose sight of the home policy of his party—having for its object the modification of the constitution of the country in a republican direction, and the weakening of the traditions of the stadtholdership. All is in unison in this regard, and even its external policy reacted in a decisive and final manner upon the result of the political struggle fought in the very bosom of the country.

Nominated pensionary-councillor in 1653, and having succeeded the following year in putting an end to the war against

England, the first hostilities of which extended back to the 29th May, 1652, John De Witt held, for ten years, the helm of public affairs, in the midst of a sea almost free from peril. The prince of Orange was still a child, and the United Provinces were at peace with the two powers whose hostility could most menace their existence—namely, France and Great Britain.

The most important events of the government of John De Witt during this period are, financial reforms at home, wars against Sweden and Portugal, and frequent mediations of the pensionary-councillor in the differences between some of the United Provinces.

The operation of conversion of the perpetual rents, which was discussed in France for several years during the reign of Louis Phillippe, and which has been successfully carried out by the Government of the Prince-President in 1852, had already, from the first half of the seventeenth century, preoccupied Dutch financiers thus early versed in the practice of public credit, the teachings and experience of which William III. carried to England at a later period.¹

The conversion of perpetual rents at 16 years' purchase, as was then the expression—that is to say, from the rate of $6\frac{1}{4}$ per cent. into 20 years' purchase—that is to say, to the rate of 5 per cent.—had been carried into operation in Holland, in 1640, and imitated immediately in the finances of the Confederation of the United Provinces.² John De Witt caused it to be renewed in the case which concerned the debt of the Confederation, as well as that of Holland, by converting the rents at 5 per cent. interest into 4 per cents. The resolution of the States of Holland, adopted upon his proposition, is dated 7th August, 1655. Its terms show³ that it was a *bond fide* conversion, with an offer of repayment to such creditors as might not accept the reduction of their interest, and that it was not, as M. Rossi⁴ has viewed it, a forced reduction.

This measure was combined with a sinking-fund system, applied to the debt of the province of Holland. The interest saved by the conversion was to be set aside, with its accumulation at compound interest, for the redemption of the converted debt.⁵ It

¹ Garnier: *Elémens de Finance*, p. 114.

² *Mémoires de Jean De Witt*, Edition of 1709, p. 312. Davies i., p. 677.

³ Van der Hoeven, i., p. 78.

⁴ *Cours d'Economie Politique* iv., p. 356.

⁵ Van der Hoeven, i., p. 76. It is enunciated in the *Letters of John De Witt*, iii., p. 101, and in Kerroux's work, p. 622, that this conversion of rents produced a saving of fourteen millions of florins per annum; but if the debt of Holland consisted of one hundred and forty millions, as is stated in the pretended *Mémoires de Jean De Witt*,

is in relation to this that M. Rossi has, with reason, attributed to Holland the invention of the sinking-fund process for the redemption of public debts. Subsequently, a deduction, which appears to have affected rather the form of a tax, reduced the interest of the State rents from 4 to $3\frac{1}{2}$ per cent.¹ Thus we find, in this small country, where the *société anonyme* was also invented, and where moveable property contributed largely to public charges by the tax of the 200th denier, the first birth of the greater part of modern economical institutions.

The war against Sweden was sustained in concert with Poland and Denmark. It gave occasion, in 1659, to a brilliant expedition against Nyborg, which did the greatest honour to De Ruyter, at the head of the Dutch squadron, and was a prelude to his glorious destiny. This expedition procured for the Danes the retaking of the island of Fünen.² Peace was concluded in 1660, after the death of King Charles Gustavus—caused, according to one historian, by surprise and grief resulting from the taking of Nyborg.³

The issue of the war with Portugal was less favourable. The cause of this war was the contested possession of the captainship of the north, which the Portuguese had joined to their possessions in the Brazils, and which was claimed by the Dutch.⁴ Hostilities between these two countries seem to have been confined to a maritime field, and were ended by a treaty signed in 1661. The litigated territory was definitively ceded to Portugal, in consideration of an indemnity of four millions of crusadoes, calculated at the value

French translation, p. 312, *et seq.*, and in Van der Hoeven, i., p. 25, the annual saving ought to have been twenty-eight millions by the reduction of interest from 5 to 4 per cent. In any event, it is difficult to explain how, even by the application of the sum of twenty-eight millions a year, the debt could have been reduced, from a hundred and forty millions in 1655, to sixty-five millions in 1672, unless it be admitted that there were other sums applied to the redemption besides the revenues saved in the conversion, as may be inferred from what is said by Simons, i. p. 150.

[M. De Parieu has, in this Note, accidentally mistaken the principal, or capital sum of the Dutch debt, for the interest thereon. Assuming the principal at a hundred and forty millions of florins, it is obvious that the annual saving, from the reduction of 1 per cent. in the interest, was 1,400,000 florins; and more than double this annual sum would, as M. De Parieu suggests, have been requisite to reduce the debt by seventy-five millions in about 16 years. Consult p. 314 of the 3rd (Ratisbon) Edition, of 1709, of the so-called *Memoirs of John De Witt*, where the calculation is that a hundred and forty millions of capital stock would be entirely redeemed, in a period of 41 years, by employment of the reduction of 1 per cent. in the rate of interest as an annual sinking-fund. This calculation is quite correct at 4 per cent.—F. H.]

¹ Simons: *Johan De Witt en Zijn Tijd, Derde Deel*, p. 100; Amsterdam, 1842.

² Van der Hoeven, i. p. 122.

³ *Ibid.*

⁴ *Ibid.*, p. 104. It is observable, that, in the conferences preceding the declaration of war with Portugal by the States-General, in 1657, the Dutch envoys made use of the Latin language.

of two Dutch florins each. Portugal had also to restore the artillery taken at the Reef¹ and in other Brazilian forts.

The treaty contains, besides, various commercial and customs' regulations.

Another part of the labours of John De Witt relates to the internal business of certain towns or of certain states of the Confederation. Thus we see him at one time bringing to an agreement the regents of the town of Gorcum; at another time, interposing, in the name of the States-General,² between the count and the States of East Friesland, in 1662.³

This peaceful interval left subsisting, without serious modification, the relations between the prince of Orange and the republican party, such as we have seen them, characterised by an admixture of defiance and respect.

These two feelings doubtless inspired the intervention of the States of Holland in the education of the young prince of Orange. In 1660, the States nominated, in fact, six tutors for the youthful prince, who had hitherto been placed under the direction of a teacher named Triglandus. Of the number of these was the pensionary-councillor, and four who had been proposed by the princess Mary, mother of the young William.⁴ Every day the prince received lessons in history and politics from Bornius, and those of another master in mathematical science. John De Witt went every Monday, according to Aitzema, to watch the young William's instruction, and to speak to him of affairs of state. Republicans were thus bringing up, with a more or less sincere interest, the prince for whom the re-established stadtholdership was but to be the stepping-stool to a throne.

In 1663, the States of Holland were, however, offended at seeing introduced into certain churches of their province, a custom, borrowed from the other provinces, of praying publicly for the prince of Orange. Thereupon they enjoined upon all the clergy to

¹ The Reef capitulated in 1654. The war between England and Holland had prevented the United Provinces from succouring their colony, as had been requested of them through the deputation sent to Europe, in 1652, by the Dutch governor of Pernambuco (see Beauchamp: *History of the Brazils* iii., p. 291, *et seq.*). De Witt has been wrongfully reproached upon the subject of this taking of the Reef.

² Van der Hoeven, i., p. 148.

³ *Ibid.* i. p. 184. Thus similarly, we find, at a later period, John De Witt smoothing differences in Overijssel (*ibid.* ii., p. 233).

⁴ See, respecting all this, Van der Hoeven, pp. 87 and 143 to 146, and the German translation of the work of Simons, p. 129, vol. i. Walter Harris, in his *History of William III.*, nevertheless accuses De Witt of having neglected the prince's education (p. 3). Burnet, on his side, says that the prince had learnt neither history nor military art (i., p. 580). After the death of the princess Mary, young William, still aged under 11 years, happily found an enlightened protectress in the person of his maternal grandmother, Amelia de Solms.

pray, in the first place, "for their noble and great powers the States of Holland and West Friesland, as the true sovereign and only sovereign power, after God, in this province; then for the States of the other provinces, their allies, and for all the deputies of the assembly of the States-General, and at the council of State." Soon, however, the attention of Dutch statesmen was to be called in the direction of graver preoccupations.

The United Provinces, at the epoch with which we are occupied, had only Spain for its solid and sincere ally, and had equally to mistrust England and France. The policy of the latter power leaned towards the conquest of the Spanish Netherlands, which were the bulwark of the United Provinces. On another side, England was the maritime and commercial rival of the United Provinces, and sought to assimilate them to her, and, in some respect, to *vassalize* them. The republic of England had sought to incorporate in itself the Netherlandish republic. The royalty of the Stuarts, in its turn, wished to drag the United Provinces into its orbit, through the bond of the stadtholdership.

The whole diplomacy of the United Provinces tended to a division of these dangerous neighbours, and the statesmen of Holland might well tremble with prophetic fear, when they saw Cromwell and Louis XIV. reunited against Spain, and, shortly after, Dunkirk retaken by the armies of this coalition (1658).

Nevertheless, when the treaty of Westminster had satisfied the exigencies of the protector, by the Act of Exclusion which was connected with it, Holland might have believed that the rivalry of national interests was about to be paralysed through certain political sympathies between the two republics.

Its confidence was brief; and when Charles II. was restored to the throne, in 1660, the government of the Hague had to fear simultaneously the political grudges attaching to some circumstances of the pretender's exile,¹ the influence of the parentage of the prince of Orange, and the commercial hostility of the two people.² Charles II. did not hesitate to show, in various circumstances, his ill will against what he called the *faction of Louvenstein*, nor to complain of the conduct of John De Witt towards his nephew.³

¹ M. Simons (1st part, p. 231, of the German translation) advances that Charles II. retained resentment on the subject of the clause of the treaty of Westminster, which denied to the republic the right of receiving any English rebel on her territory. Hume adds, that Charles II. had as much aversion from the Dutch character as taste for the French character (ch. lxix).

² Van der Hooen relates different attacks directed by the English against Dutch commerce in 1664 (ii., p. 224).

³ Kerroux, pp. 706, 727, 783.

The defensive alliance, concluded on the 27th April, 1662, between the United Provinces and France, showed on which side were, not the confidence and friendship of the Dutch, but their least fears. Notwithstanding the efforts of the United Provinces to appease the rupture, Charles II. declared war against them on the 4th March, 1665.¹

In this formidable struggle, in which the British hostility was supported by an attack of the bishop of Munster, France remained inactive down to the moment when she might fear lest war should produce, in the Low Countries, a reaction favourable to Orangeism. Then Louis XIV. decided to send help to the States-General, and he even declared war against England, without, however, ever joining his fleets with those of the Seven Provinces, which thus had to support almost alone the weight of the struggle.²

Van Opdam, Cornelius Tromp, Cornelius de Witt, and particularly De Ruyter, disputed the empire of the sea with the English flag. John De Witt himself was distinguished, not only for his administrative services, but further, for his nautical skill, and guided the exit of a squadron through a difficult passage. The invention of the chained balls used in the course of this war has even been attributed to him.³ This struggle of three years does so much honour to the government of John De Witt, that we may properly recall its principal turns of fortune.

The opening of the naval war was unfortunate for the Dutch. Met by the English fleet on the 13th May, 1665, at ten leagues from the coast of Suffolk, the fleet of the United Provinces sustained a sad defeat. The ship of admiral Wassenaar Van Opdam was blown into the air. The lieutenant-admiral of the "Meuse," Kortenaar, was also killed in the fight, and several Dutch captains did their duty so badly as to deserve severe punishment; whilst the glorious death of Kortenaar and of Wassenaar Van Opdam was recompensed by two of those marble mausoleums, which revive, in the silence of the temple and to the eyes of the traveller in Holland, the renown of the ancient navy of the country.

The United Provinces made the most generous efforts to repair this disaster; and on the 14th August of the same year, they again

¹ Hume relates that Charles II. was suspected of having declared war against the Dutch to divert a part of the subsidies conceded on account of the hostilities. He adds, that the taste of Charles II. for marine affairs might have contributed to his determination.

² It is right to observe, that the necessity for showing front to the formidable approaches of the French fleet did sometimes weaken the English squadrons.

³ Van der Hoeven, i., p. 251. John De Witt renewed a nautical exploit analogous to that which we have just referred to, in 1672 (*ibid.*, p. 279). See also the German translation of Simons, part ii., p. 173.

put to sea a naval force, composed, without counting fire-ships and yachts, of 92 vessels, carrying 4,337 cannon, 15,000 sailors, 1,283 marine soldiers (marines), and 3,501 soldiers of the land force. The fleet was placed under the command of De Ruyter, directed by three representatives of the States, Huyghens, Boreel, and the grand pensionary himself, who, on this occasion as on several others, was replaced in his office by his nephew Vivien, pensionary of Dordrecht. It was, in fact, then the custom in Holland, as in the middle ages at Venice, and, later still, under the French republic in the last century, for military commanders to be assisted and watched in their operations by delegates from the civil power to which they owed obedience.

The Dutch fleet sought in vain, until the month of October, for the British squadrons, without finding an opportunity of fighting them.

It was otherwise in the year following. De Ruyter, whom De Witt had helped in getting ready the armament without following him this time to sea, gave furious battle, on the 11th and 12th June, in the Downs, to the English fleet commanded by Monk, now duke of Albemarle, and compelled it to retreat towards the Thames; but the English having received reinforcements on the 13th June, the battle began again the next day. After a last and warm encounter, in which De Ruyter and Tromp fought like heroes, the English squadron of the white set sail northward, while the admirals of the red and blue took refuge towards the coast of England. The fog interrupted the pursuit of the Dutch, who returned gloriously to Wielingues, with a loss of only four vessels, whilst the English had twenty-three to deplore. The English admiral, Ayscough, taken prisoner, was made a sight of to the people of the Hague. We have two bulletins of this long battle. The letter of Monk to Sir W. Coventry is brief. The duke of Albemarle writes, that he had never fought with worse officers, and that there were not more than twenty out of their number who had behaved themselves like men.¹ John De Witt has on the other hand left us, in an official report, the detailed recital of this brilliant victory of the Dutch,² which was, unhappily,³ compensated shortly afterwards by a reverse (on the 14th August), in the sequel of which Tromp, disagreeing with De Ruyter, had to give way to the superiority of him who had become his chief after

¹ See the letter, wrongly dated, in Pepys i., p. 110, of the 8vo. edition.

² Van der Hoeven, pp. 25 to 37.

³ Happily, from an English point of view.—*F. H.*

having been the pupil of his illustrious father,¹ and was replaced by Van Ghent.

The year 1667 saw accomplished, under the direction of Cornelius de Witt as deputy of the States, and of the admirals De Ruyter and Van Ghent, a maritime expedition of the most daring kind. A powerful Netherlandish fleet, carrying some boarding troops, directed itself in the early part of June towards the mouth of the Thames, took possession of the fort of Sheerness, in course of building on the Isle of Sheppey, and went as far as Chatham up the Medway, a river which runs into the Thames on the right of its mouth. Several vessels sunk in the river by the English, and their firing from the castle of Upnor, did not prevent the Dutch from taking or burning nine large English vessels, amongst which was the "Royal Charles," that had brought back to England the restored sovereign, whose name it bore. The States-General were very proud of the success of the Chatham expedition. Richly chased golden cups, around which the taking of Sheerness and of the English ships was represented in enamel, were given to Cornelius De Witt and admiral De Ruyter. The latter received, in addition, a stock-coupon representing a capital of six thousand florins, and lesser sums were allotted to the chief officers who had lent him their assistance.² The success of the Chatham expedition spread fear into London, and hastened a conclusion of the negociations for peace, which were shortly afterwards signed at Bréda.

This war period appears to have produced a double and opposite effect upon the political situation at home. On one side was seen Orangeism oft awakening in the recollections of the Dutch people, uneasy at one reverse or another; and, contrariwise, the defiance of the opposition party increasing in like proportion. In 1666, the States of Holland, under the influence of this feeling, changed two of the tutors entrusted with the prince's education, and made fresh appointments of the persons of his household and of the gentlemen of his chamber.³

Nevertheless, as the prince advanced in years, so grew in the eyes of far-sighted men the prognostics of his influence. The star of his future was perceived by many; and, in 1666, a member of the States-General was able to exclaim, with penetrating raillery:

¹ Martin Tromp, killed in 1653 in the war against Cromwell.

² Holland was parsimonious to her servants, and John De Witt, whose allowance at the outset was 3,000 florins, did not receive at the epoch of his greatest power more than 7,000 florins a year as pensionary-councillor.—See the work of Simons, part iii., c. 2.

³ Van der Hoeven, ii., pp. 17 and 18.

“Holland thinks to make of the prince a child of the State, but I see that in a little while she herself will be a child of the prince.”¹ On board the very fleet of the States, Orangeism, professed by Cornelius Tromp, had burst out with demonstrations in the midst of a war conducted with skill and courage by the opposite party.²

There is often a culminating point in a man's fortune, beyond which decline begins. The epoch which followed the conclusion of the peace with England at Bréda, on the 13th July, 1667, represents this fact in the political fate of the brothers De Witt. It was at the close of 1667 that the perpetual edict abolishing the stadtholdership was voted and sworn to by all functionaries, with, it is said, a single exception.³ In 1668 was signed the triple alliance, concluded between the United Provinces, England, and Sweden, with the view of protecting the United Provinces against the threatening ambition of Louis XIV. The preceding two acts represent the triumph of the mind of John De Witt within and without his country; but they also mark the diverging point of a reaction, whose ultimate end is the torment inflicted upon the two brothers by popular passion.

The perpetual edict of 5th August, 1667, attributed by some historians to the fear with which the States of Holland were inspired by the plots contrived to support the English arms,⁴ was a factitious success, exceeding the true strength which belonged to the party that obtained it, and the true state of public opinion in the United Provinces.

All history affords a certain number of these circumstances, in which a political party, profiting by its ascendant, gains an ephemeral triumph, which the natural working of events and the order of things destroy. We have noticed the powerful roots of Orangeism when it was only represented by an infant;—how much more confident and proud should the party have been when the young William was approaching his majority, and beginning to show to all eyes the wisdom of his mind and the firmness of his character!

This was the moment when the party of the brothers De Witt, making a bad use of the scope of its own power, endeavoured to close the future of the young prince. His banishment alone, if it had been possible, would have been suited to ensure such a result, and instead of that, three years after the perpetual edict, the son and heir of the stadtholder was voluntarily called to the Council of

¹ Van der Hoeven.

² *Ibid.* i., pp. 243—250.

³ *Ibid.* ii., p. 197.

⁴ Raynal: *Histoire du Stadthouderat*, edition of 1750, i., p. 221.

State, through the sole fact of the influence of his name and position.

The triple alliance, the idea of which was doubtless easier of justification in the face of the growing progress of Louis XIV.'s ambition, was not, in reality, less insignificant nor less dangerous. All political tækings-about have in general their dangers. The maritime rivalry between the English and Dutch nations, the ties of the prince of Orange to Charles II., and the opposition of the monarchal spirit, restored in England, to the republican spirit of the government of John De Witt,¹ were, besides, evident and special dangers to the triple alliance.

The wish of Charles II. to destroy in his country, with the help of Louis XIV., Protestantism and public liberty, gave the mortal blow to this combination. With the aid of some seductions, Louis XIV. easily succeeded in withdrawing the English government from the triple alliance; and from that moment, the United Provinces, betrayed by Sweden, and reduced to the support of Spain and Brandenburg,² were exposed to the ambition and resentment of Louis XIV. Did John De Witt (who was in the wrong in not foreseeing the danger far off enough, and in allowing the territorial military condition of his country³ to become disorganized) do, administratively and militarily, all that was suited to allay the danger, and was he only paralysed in his efforts by the stadtholder's party, as writes the Abbé Raynal?⁴ I am inclined to think so,⁵ notwithstanding some reproaches which have been directed against him in this respect. But it is evident that, with restricted military resources, with germs of treasons at home, which burst forth soon after,⁶ and finally, with the enormous preponderance of Louis XIV.'s forces, the most far-sighted efforts would soon have proved almost completely useless.

The whole policy of the anti-stadtholdership government had rested upon the division between France and England. The alliance of these two States struck it a fatal blow; and the political retirement of the pensionary would scarcely have sufficed to cut

¹ The Court of England had been much annoyed by certain writings and medals disseminated in Holland.—Van der Hoeven, ii., pp. 243, 244.

² Frederick William, the *great elector*, true founder of that which has since become the kingdom of Prussia, possessed at this period Brandenburg, the Duchy of Prussia, Eastern Pomerania, the Archbishoprics and secularized Bishoprics of Magdeburg, Halberstadt, Minden, and Camin. He bordered upon the Netherlands, through the possession of Cleves and Berg.

³ Davies, iii., pp. 79 and 91.

⁴ I., p. 245.

⁵ See, in this point of view, Van der Hoeven, pp. 247, 258, 264, 298.

⁶ *Ibid.*, pp. 240 and 261.

asunder this coalition of two great external powers, supported by the discontent of a great party at home.

John De Witt, *simultaneously*, according to Voltaire,¹ *quite a republican, and jealous of his own particular authority*, understood it only imperfectly; and the measure which, at the beginning of 1672, declared the prince of Orange captain and admiral-general, was too tardy for the people and too restricted to regain for De Witt the mind of the prince.² The invasion of Holland by the armies of Louis XIV. was inevitable. Discouragement and treason accelerated its progress; but the Dutch fleet did honour to the imminent disaster of the country, by the memorable battle of Solesbay, fought 7th June, 1672, and in which De Ruyter coped with the two admirals of France and England. Cornelius De Witt, deputy of the States on board the fleet, saw several of his guards fall at his feet under the enemy's fire. His companion in the Medway expedition, Van Ghent, wounded in the fight, died in it, to use the Dutch expression, *on the bed of honour*.

There might have been anticipated for the armies of France, upon the territory of the United Provinces, a triumph greater than it failed to be through want of skill in the direction of their operations. But that which constitutes a striking political phenomenon, is the violence of the reaction produced by the French invasion in the home government of Holland and of the United Provinces. It was not enough for the people to have seen the two brothers De Witt deprived in a few days of their influence and of their power. He who had been so recently honoured at Chatham and Solesbay, was accused before the court of Holland of having contrived a plot against the life of the prince of Orange. After undergoing the torture of the rack, supported with a courage which has become historic,³ Cornelius De Witt was condemned to banishment by a sentence which defined no crime.⁴

Brought near to the noble prisoner by a brotherly visit, John De Witt found himself hemmed in with him by the riot. The two brothers were massacred at the Hague, on the 20th August, 1672, near to the Gevangenpoort, not by a few individuals of a populace gone astray, but with the assistance of the burghers,

¹ *Siècle de Louis XIV.* i., p. 396, Ed. of 1830.

² See the 13th chapter of the 3rd part of Simons's work.

³ It is asserted that he recited to his judges, in the midst of the most cruel agonies, these verses of Horace—

“Justum ac tenacem propositi virum,
Non civium ardor prava jubentium,
Non vultus instantis tyranni
Mente quatit solida.”

⁴ Kerroux, p. 819.

armed to keep order, and as victims of a kind of political execution. Their remains, mutilated with an atrocity which almost makes humanity blush, scarcely found an obscure resting-place, but lately discovered;¹ and, as if everything in this sad drama was destined to bear a character which the generosity of our century can no longer understand, one of their murderers was rewarded.²

Their disaster confounds itself with the progress of the fortune of him whose greatness they had sought to stay, and who was about to owe each of his successes to the faults of Louis XIV.

Elevated to the stadtholdership by the counter-stroke of the aggression of the great king against Holland, aided in his conquest of the throne of England by the hatred of French influence visited upon James II., fortified in his army by the Protestant refugees whom the revocation of the Edict of Nantes had driven from France,³ William III. closed in his kingdom the era of political revolutions, and, according to a memorable appreciation, "*a assuré la religion, la gloire, et les libertés de l'Angleterre.*"⁴

The corpses of the brothers De Witt were thrown, by the fury of a humiliated and uneasy people, at the feet of that brilliant destiny which had no need of so odious a sacrifice. Equitable history has, so to speak, drawn them from the tomb in which they were thrust with their policy, by attenuating their faults, through the exaltation of their intentions, of their talents, and of their courage.

Those who, in the course of time, have changed the foundations of their country's governments, attract the attention of the world by qualities needful for these great political transformations. Without being upon an equal level with those powerful instruments of Providence, in whom are personified the great revolutions to which I allude, John De Witt was enabled to maintain in a semi-monarchical country a kind of republican regency, long uncertain perhaps of its definitive tendency, but which scarcely ceased to be glorious until the day when it ceased to exist.

In a country limited in extent, but powerful withal, De Witt exhibited something of the virtuous career of a Washington. But he did not, like the latter, attain the honour of representing

¹ They were transferred, in the night of the 21st to 22nd August, into the vault which John De Witt possessed in the new church at the Hague (Kerroux, p. 837). M. Veegens has published, upon this point, a letter, in which he advances that the tomb is marked by the number 77 in the church referred to (*Jets over het graf der de Witten. Uit eenen brief aan M. J. Heemskerk*).

² Kerroux, p. 841.

³ Upon the history of the French refugees, see the *Moniteur Universel* of the 2nd and 3rd November, and 3rd December, 1851.

⁴ Expressions of the Emperor Napoleon III., i., p. 243 of his *Œuvres*.

the stable and enlightened aspiration of his country; therefore he fell beneath the blows of an adverse party: and, notwithstanding the value of his services, the defender of Dutch liberty found, amongst his own, more murderers than republican passion has ever, perhaps, armed against any master.

History ought not to search too systematically amongst human destinies for the precise retribution of its heroes' merits.

Contemporary with De Witt, the fanatic Cromwell came to his end, in the midst of prosperity. We may say of him, like of Sylla, that he died

———"Tranquille,
Comme un bon citoyen dans le sein de sa ville ;

and his inanimate ashes were alone the object of the vengeance of that power which he had violently dethroned.

De Witt, after having co-operated in the education of William III., and after having disputed the future only of his policy, perished like a malefactor, given up to popular frenzies affecting a shadow of justice. Posterity, which sometimes rectifies the decrees of fortune,¹ has shown itself equitable by reinstating his memory and glorifying his virtues; but, under any circumstances, the saintly glory shed by misfortune around the name of this upright and able minister, ought not to blind the judgment of history to his errors.

The work of John De Witt was a struggle against the impossible; and, as it were, the expression of two great misconceptions in the line of diplomacy and politics. De Witt was unable, after the Act of Exclusion and the Perpetual Edict, to recover the sympathy of the uncle of the prince of Orange. He flattered himself, it is said, but in vain, to regain it by concessions trafficked for the prince's advantage, but forgot too much, as Burnet observes, the catholic and absolutist sentiments of Charles II. The moment he separated himself from France, whose ambition he with reason feared, and whom he had so cautiously treated sometimes, as to appear to certain writers of his own country to have been blinded by her,² his fall was inevitable. But that which above all brought on this reverse was a presumptuous idea, which deceived De Witt, respecting his true mission in the home affairs of his country.

¹ Fox has said of him, "The most truly patriotic minister that ever appeared on the public stage;" and Raynal, perhaps a little exaggerating in his appreciation of Cornelius De Witt, calls him *the greatest man of the republic, after his brother*. Did not this eulogy belong more appropriately to the illustrious friend of John De Witt, Michael De Ruyter?

² See the little work published at the Hague, in 1757, under the following title: *Het Karakter Van den Raad pensionaris Jean de Witt, en zyne factie beschreeven door den Graf d'Estrades*, &c.

Instead of preparing for the advent of the future stadtholder, in the midst of a government benevolent towards the House of Orange, conciliatory and firm, he wished to suppress the stadtholdership and to establish a sort of republican oligarchy in Holland.

De Witt represents, perhaps, in his country—saving the difference of the times, characters and circumstances—that aristocracy which has not known, in scarcely any part of modern continental Europe, how to establish its true position betwixt the dynasties and the people. More excusable, doubtless, than those French gentlemen who dreamed a republic in the sixteenth century, he appears to have misconstrued the difficulties presented in the basing of a government upon the foundation of the isolated aristocratic principle. It was not given to him to read in the decline of Venice, which had already begun in his time, the signal of the future fall of this oligarchical republic.

De Witt knew neither to ally himself with the prince of Orange nor to interest the democracy in his cause.¹ These two elements entered into a coalition against him, or at least the second became the instrument of Orangeism to his ruin. Burnet has besides reproached him with not having sufficiently upheld the authority of the Council of State, and with having too much left the executive power in the assembly of the States, as also with having too much lessened the authority of the judicial courts at the Hague for the advantage of the local jurisdictions.² The preceding are secondary faults, which, well or ill proved, have in any event rather facilitated than occasioned the decay of his power.

The political error of John De Witt led him sometimes to means which were somewhat deficient in straightforwardness. Admitting that the part he played in the Act of Exclusion is completely cleared up,³ his tactics respecting the young William were often a trick upon public feeling.⁴ His conduct, too, towards De Buat and Van der Graaf⁵—just, strictly speaking—may, never-

¹ The author of the *Encyclopédie Méthodique* reproaches John De Witt in this last respect (*V^o Provinces Unies*).

² Vol. i., p. 584.

³ The only positive testimony against De Witt, quoted with that view by Kerroux, p. 704, is that of D'Estrades, who is convicted of error upon certain facts, such, for instance, as upon the part of ambassador, which he attributes to De Witt, at the time of the treaty.

⁴ Kerroux, p. 132.

⁵ De Buat left at De Witt's house, through carelessness, a letter which contained the sketch of a plot in favour of the prince of Orange. He was condemned to death and executed, the 2nd October, 1666. Van der Graaf, more culpable, was of the number of those who conspired against the person of the pensionary two months before the massacre of the 20th August, 1672. "He died," it is related, "with great sentiments of piety and repentance, and was looked upon by the friends of the House of Orange as a martyr to the interests of that House" (Kerroux, p. 797).

theless, have presented to angry assemblages the aspect of flagrant severity !

Under every circumstance, the passions before which he fell ought to have been disarmed, on account of his personal character. Eminent for his probity in a centre of corruption, where the ambassador of France could only pick out, besides the brothers De Witt, two incorruptible public men, he was also full of patriotism and activity. The hatreds which reached him were then in a great measure the result of the passions of his enemies, of the violence of the times, and also of the restraint experienced by a country upon which the development of the monarchical form was almost forced by its antecedents and by the requirements of its external policy, and which found in that governmental form a pledge of confidence and of security.

“ If this virtuous and zealous citizen,” says Condillac of him,¹ “ had succeeded in ruining the hopes of the young William III., and had proscribed the stadtholdership for ever, we cannot disguise from ourselves that the United Provinces, far indeed from being able to find within themselves the resources necessary for repelling the blows with which they were threatened, would have been led to inevitable loss by the vices of their government and of their constitution.”

If it were permitted to me to seek for the cause of the faults of the celebrated and unfortunate pensionary, in these personal and intimate circumstances, difficult to establish at this distance of time, but which are of so high a degree of importance to the historian, I would venture, perhaps, to say that these faults resulted—first, from the birth of John De Witt in the bosom of a party and of a family exacerbated by the acts of the Orange policy; and also, secondly, from too absolute a line of conduct, be it the result of the influence of the party, or else of the nature itself of the pensionary’s own mind.

De Witt was a mathematician and geometrician. The development of his education and of his thoughts in this direction² explains at one and the same time his financial and his nautical aptitude, and probably also, to a certain degree, the somewhat obstinate tendencies of a literary and learned mind, but which certain ill-explained testimonies and difficult, at least, to admit entirely,

¹ *Cours d’Études* vi., p. 198.

² John De Witt is the author of a little geometrical work, printed under the title of *Elementa Linearum Curvarum*, published for the first time, according to Van der Hoeven, by Francis Van Schooten, Professor of Mathematics at the University of Leyden, at Louis and Daniel Elzevir’s, Amsterdam, 1659.—Van der Hoeven, i., p. 14.

pretend to have been defective in sufficient historic and diplomatic instruction.¹

De Witt was, moreover, a perspicuous economist, an anticipator, in several respects, of the views of modern science; and he appears to have understood the advantages of freedom in trade and industry.² He passes for having been the joint author of a work translated into French under his name,³ and in which, besides an apology for the republican policy and a criticism upon the policy of the stadtholdership, viewed as stained with dynastic egotism and warlike passion, some curious details are found upon the commerce and finances of Holland, and a just foresight of the danger of the enormous taxation to the prosperity of that country.⁴

De Witt extended his preoccupations to various branches of public credit, and was the author of a fortunate conversion of perpetual annuities; he had also fathomed the operations of Life Annuities, then much resorted to in Holland. The treatise of John De Witt upon the "Value of life annuities compared with that of perpetual annuities," has for its object, to establish, by the observations of experience and the calculus of probabilities, that the State, assuring perpetual annuities at 25 years' purchase, ought collaterally to assure life annuities to nominees of a young age, at 16 years' purchase; and that it had sustained a loss in granting them, at different periods, at 6 years' purchase, at 7 years' purchase, at 8 years' purchase, at 11 or 12 years' purchase, and even again at 14 years' purchase, according to the scale adopted at the time of the composition of this work.

The memoir of John De Witt, recently discovered by Mr. Hendriks, Actuary, and Fellow of the Statistical Society, of London, has

¹ I only quote with hesitation, in default of authorities being indicated, the following passage from an historical dictionary, composed by a society of men of letters, where it is said, upon the subject of De Witt:—"Not acquainted, in any way, with modern history or with the state of foreign Courts, he committed the most gross faults upon matters of ceremony."

We are assured that there exists at the library of Leyden a collection of letters of John De Witt, bearing witness to a large acquaintance with French and Dutch literature.

² The *Encyclopédie Méthodique*, article *Finances*, under the word *Maîtrise*, quotes the following passage, attributed to John De Witt:—"It is a hurtful and very useless thing to limit manufactures by guilds or trade-bodies, directors or provosts, or to order in any way in what manner the manufactures which are trafficked with foreign countries are to be made."

³ The body of this work, published in 1670, in Dutch, under the title of *Anwysing der politike gronden en maximen der Republike van Holland en West Friesland* (Explanation of the bases and political maxims of the Republic of Holland and West Friesland), and translated into French under the title of *Mémoires de Jean De Witt*, is attributed to P. de Lacourt.

⁴ See chapter xii. of the *Mémoires de Jean De Witt*, translated from the original into French; the Hague, 1709. The chapter is entitled—"That the too great taxes will at length drive away all prosperity from Holland."

been translated by him into English in his *Contributions to the History of Insurance*.¹ This memoir, distributed by the pensionary to the States of Holland, in 1671, appears to have been suppressed, as inopportune, shortly after its composition; and for the motive that the States-General were soon obliged, under the blow of the dangers of the year 1672, to offer life annuities at 10 years' purchase, on account of the tightness of public credit.²

"Let us concede," says Mr. Hendriks on the subject of this work, the disappearance of which had long been regretted, "that the then novel and ingenious views, and the many germs of truth, contained in De Wit's treatise and other labours on the subject of life annuities, did honour to his discrimination as a mathematician, and to his judgment as a statesman; and that he may be considered as the first who perceived that a new-found science, which was but beginning to attract the attention of philosophers of his day, could be applied, not solely to the investigation of the hazards of players at ignoble games of cards and dice, but also to the business of life and to the good of the commonwealth!"

The preceding lines ought to form a part of the intellectual portrait of a statesman whose political life has fixed our attention, and even tempted our pen, without inspiring us, nevertheless, as the reader will have perceived, with the ambition of becoming his real historian.³

¹ London, 1851; printed by Laytons, 150, Fleet Street. It is inserted in pages 40 to 57. (The reference is to the privately-printed copy of Mr. Hendriks's paper.)

² *Vide* the second fragment of the *Contributions to the History of Insurance*, p. 28. (Third fragment in *Assurance Magazine*, vol. iii., p. 120.)

³ M. Ant. Lefèvre Pontalis, auditor of the Council of State, is occupied with extensive researches upon John De Witt. There may be expected from them interesting light on this remarkable period of a history which has not yet been treated upon in the French literature of our century. M. Combes, inspector of the Academy, recently charged with a mission, from the Minister of Public Instruction, to Holland, has also gleaned there information upon the epoch of John De Witt, and various curious letters of the councillor-pensionary written in the French language.

[Amongst other Frenchmen of eminence who interest themselves on the subject of De Witt may be noticed M. Guizot, who was present at the reading of M. de Parieu's paper before the Academy of France, and who is connected by marriage with the De Witt family. One of his daughters is married to M. Conrad De Witt, and the other to M. Cornelius De Witt, and we have the best authority for mentioning that their families were residing last autumn with the illustrious ex-statesman at Val Richer.—F. H.]

[Following M. de Parieu's example, the name of De Witt has, throughout this paper, been spelt with two *t*'s. It will, perhaps, be recollected, that in the papers for which Mr. Hendriks is responsible, the name was spelt with only *one t*. The latter orthography of the name was adopted, not on light grounds, but upon collation of such contemporaneous evidence, documentary, medallion and typographical, as was at hand. The conclusion arrived at was, that De Witt used to spell his name in more ways than one—like Buonaparte and numberless others.

The following questions were based upon this evidence, and inserted, by Mr. Hendriks, in *Notes and Queries*, 2nd February, 1856:—

Travellers may see at the Museum of Amsterdam his physical image, painted by De Baan. The face of the pensionary is intellectual and grave. One might find some remote likeness (if my impressions, deprived of an immediate point of comparison, be correct) to the features of Fénélon.

Holland, great in its influence on former times and small in its territory, has been endowed with a genius less severe, less grand and less absolute—but more practical, more natural, and more varied—than that of Venice; she has had, during the seventeenth and eighteenth centuries, a specimen, so to speak, of all glories. What Huyghens was for her in science, Rembrandt and so many others in painting, Spinosa in philosophy, De Ruyter, the two Tromps and Cohorn in the art of war, Grotius in jurisprudence, Boërhaave in medicine, that John De Witt and William III. have also been (the former so unlucky, the latter so fortunate), and by different claims, in the lofty career of politics, which rests, perhaps, upon the most elevated and most difficult of human sciences, as it does upon the noblest and the most sensitive of arts.

- “1. Did the grand-pensionary, in his Latin correspondence with learned foreigners, or in signing diplomas and instructions in Latin, spell his name, habitually with one *t*?
- “2. Did the grand-pensionary sign letters and state documents, in Dutch, habitually with two *t*'s?
- “3. Was there a period when the grand-pensionary changed his ways of spelling his signature?
- “4. If queries 1 to 3 remain unsolved, are we not, nevertheless, justified in assuming that the facts above adverted to (*viz.*, the evidence detailed) are sufficient to leave it open to us to spell the name either with one *t* or else with two *t*'s; and to be equally free from the possible discomfort of the criticism of etymologists, or from the charge of abetting the ambiguity with which the ‘printer's devils’ of all countries treat the name of De Wit?”

These queries do not seem to have yet been answered; but, since their appearance, a very acute correspondent of *Notes and Queries*, writing under the initials H. B. C., altered (we assume, of course, the correctness of the printing) his way of spelling the name, from De Witt to De Wit. This alteration occurs in the course of the articles in which H. B. C. so fairly explains the barbarous conduct of William III. towards the De Wits, a conduct which is as great a blot upon his memory as is the massacre of Glencoe.

We are aware that some readers will say that the subject of this particular note is of no great importance. But we may reasonably differ from such a view, even on general grounds, in England at the present time (June, 1859), when the question whether the spelling of Bordeaux with two *u*'s, or of Hofer with two *f*'s, be excusable or not, has just been a bone of contention between the supporters of the Civil Service Examination Commissioners, on the one side, and of Lord Malmesbury, *ex parte* the diplomatic service, on the other.—*F. H.*]

CORRESPONDENCE.

ON THE RULES FOR FINDING THE SPECIFIC SUMS INSURED ON THE DIVISIONS OF RISK UNDER FIRE INSURANCE POLICIES.

To the Editor of the Assurance Magazine.

SIR,—The question brought to notice by your correspondent “R. B. F.” furnishes a good opportunity of showing with what ease specific and average policies may be made to combine to pay *rateable* proportions of loss on property jointly insured by them. Referring, for discussion of the principles of apportionment, to the papers in the *Assurance Magazine*, vol. vi., page 282,¹ and vol. viii., page 140,² I shall here merely state, in algebraic symbols, the rules for finding the *specific sums insured* on the divisions of risk, as it is in proportion to them that the loss should be divided.

Let V = the value of the property covered by any policy,

S = the sum insured, and

L = $l + l' + l'' + \&c.$ —that is to say, the total loss equal to the sum of the partial or divisional losses; then

$\frac{S}{V} \times l + \frac{S}{V} \times l' + \frac{S}{V} \times l'' + \&c.$, are the divisional *specific sums insured* by the *average* policies on the property destroyed, their total amount being $\frac{S}{V} \times L$; and

$\frac{S}{L} \times l + \frac{S}{L} \times l' + \frac{S}{L} \times l'' + \&c.$, are the divisional *specific sums insured* by the *specific* policies, their total amount being equal to S.

The aggregate amounts in the case under consideration being—

		Sums insured.			
<i>Specific—</i>	By A,	Rd. 40,000	on merchandise, including sugars, in A to L.		
“	“ C,	38,000	“ “ “ “		
“	“ D,	85,000	“ “ “ “		in A “ to K.
“	“ D,	10,000	“ “ “ “		in L.
<i>Pro rata—</i>	“ B,	30,000	“ “ “ “		in A to L.
“	“ E,	30,000	on sugars		in A to L.
		Values.		Loss.	
Sugars, in A to K or A to L .		Rd. 138,358		Rd. 84,719	. . . (1)
Other merchandise, in A to K .		88,743		49,953	. . . (2)
		227,101		134,672	
Ditto, in L only		6,827		6,827	. . . (3)
		233,928		141,499	

then the form $\frac{S}{L} \times l, \&c.$, gives the divisional *specific sums insured* by the *specific* policies; thus—

By A, $\frac{40,000}{141,499} \times 84,719 = 23,949$ = specific sum applicable to bear loss on (1)
 “ $\times 49,953 = 14,121$ = “ “ “ on (2)
 “ $\times 6,827 = 1,930$ = “ “ “ on (3)
 By C, 22,752 on (1); 13,415 on (2); 1,833 on (3);

¹ “A Problem in Fire Insurance: ‘To apportion a given Loss on Property insured by Specific Policies.’”

² “A Chapter in Fire Insurance: ‘Specific’ and ‘Average.’”

the calculation being the same as last, substituting 38,000 for 40,000 as the amount insured.

By D, $\frac{85,000}{134,672} \times 84,719 = 53,472 =$ specific sum applicable to bear loss on (1)
 " $\times 49,953 = 31,528 =$ " " on (2)
 And by distinct item, 10,000 . " " on (3)

The form $\frac{S}{V} \times l$, &c., gives the following divisional *specific* sums insured by the *average* policies, viz.:—

By B, $\frac{30,000}{233,928} \times 84,719 = 10,865$. . . on (1)
 " $\times 49,953 = 6,406$. . . on (2)
 " $\times 6,827 = 875$. . . on (3)
 By E, $\frac{30,000}{138,358} \times 84,719 = 18,370$. . . on (1)

Combining these figures in a tabular form, and dividing the loss in proportion to the several sums, we arrive, without further trouble, at an adjustment of the claim which in every respect fulfils the conditions of the insurances, viz.:—

	PROPORTIONAL AMOUNTS INSURED SPECIFICALLY BY					
	A.	B.	C.	D.	E.	Totals.
Sugars in A to K	23,949	10,865	22,752	53,472	18,370	129,408
Other merchandise in ditto	14,121	6,406	13,415	31,528	..	65,470
Merchandise in L	1,930	875	1,833	10,000	..	14,638
Rd.	40,000	18,146	38,000	95,000	18,370	209,516

	RATEABLE PROPORTIONS OF LOSS.					
	A.	B.	C.	D.	E.	Totals.
Sugars in A to K	15,679	7,113	14,895	35,006	12,026	84,719
Other merchandise in ditto	10,774	4,888	10,235	24,056	..	49,953
Merchandise in L	900	408	855	4,664	..	6,827
Rd.	27,353	12,409	25,985	63,726	12,026	141,499

If a person insured goods worth £1,000 for £500, then, by the *pro rata* condition, he would himself be held as an insurer of £500, and bear his share of a loss in like proportion. The meaning intended to be given to that condition, therefore, seems to be that the property destroyed shall be considered as insured for its full value—the deficiency in the amount insured by the Offices being insured by the assured himself; and the evident object of the condition is the same as that of the average clause, viz., to fix the amount which the Office shall insure on the property destroyed, which amount will only be $\frac{S}{V}$ of the loss. By the preceding table it will be seen that, in consequence of specific policies having to bring the *whole*

sums insured to bear upon each loss, there is actually a greater amount insured than is required to satisfy the *pro ratâ* condition; so that the policies effected with that condition sustain a smaller proportion of loss than they would have done had the assured either been his own assurer for the excess of sums beyond the amounts insured by them or insured it in another Office. The assured should not, therefore, bear any share of the loss himself, as his obligation to the *pro ratâ* policies has been satisfied by the substitution of the specific policies.

I am, Sir,

Your obedient Servant,

London, 18th April, 1859.

THOMAS MILLER.

REPLY TO PROFESSOR DE MORGAN'S REMARKS AS TO THE AUTHORSHIP OF GRAUNT'S OBSERVATIONS.

To the Editor of the Assurance Magazine.

DEAR SIR,—I have read, with all the attention due to the authority of so eminent a writer, Professor De Morgan's letter, published in your last Number,¹ criticising the assertion quoted by me, that the *Observations on the Bills of Mortality*, published in the name of Capt. John Graunt, were actually written by Sir William Petty.

The question of the authorship of the earliest work upon vital statistics can hardly fail to be considered an important one by persons interested in the science, among whom will, no doubt, be found the great majority of your readers; and I trust I may, therefore, be permitted to intrude upon your space for the purpose of stating why the facts and arguments adduced by the learned Professor appear to me less conclusive than he evidently considers them.

Before going into the discussion, however, I must point out that, whatever may be thought of the assertion in question, your correspondent is certainly in error when he attributes the revival of it to me—thereby implying that it had been previously an obsolete and exploded opinion.

So far is this from being the case, that I have generally found a similar view to my own entertained by the few persons I have met with who have paid attention to the subject; and this view has been promulgated in more than one popular work of recent date.

Of all the books published during the present century, relating to the time when Graunt and Petty lived, the one most extensively read has been, undoubtedly, Macaulay's *History of England*; and, next to that, may probably be placed the *Diary of Samuel Pepys*. Now, both the author of the first and the editor of the second of these concur in ascribing the work under consideration to Petty.²

Let us examine the facts brought forward in support of a contrary opinion. It is stated, 1stly, that the work was published in the name of Graunt; 2ndly, that he derived great reputation from it, and was, in consequence, elected a Fellow of the Royal Society; 3rdly, that Sir William

¹ *Assurance Mag.* viii. 166.

² See Macaulay, 1st edition; Lond., 1849, i. 282, Note. Pepys, 4th edition, Lond., 1858, i. 266, Note.

Petty, in his published writings, although he occasionally mentions the book as his own, much more frequently speaks of it as Graunt's; 4thly, that he published an edition of the work, in which Graunt was described as the author.

Of these facts the third and fourth only require consideration, because the first and second are in entire accordance with the assertion controverted, which is, that, although the work was written by Petty, it was, with his concurrence, published in the name of Graunt.

It is not necessary for us to determine what could have been Petty's object in making such an arrangement—whether it was for some personal convenience or advantage to himself, or merely to gain a reputation for Graunt; but assuming that he did make it, his subsequently speaking of the book as Graunt's appears to me not only natural but inevitable.

Sir Walter Scott would have been guilty of a very curious piece of inconsistency, at the time he wished his connection with the *Waverley Novels* to remain a secret, if he had referred to them as his own, in a work published with his name; but Petty had much more reason for adhering to the original fiction, if fiction it was, because, in denouncing it, he would have exposed his friend to ridicule and contempt, by stripping him of the borrowed plumes, which, according to the hypothesis, Petty had himself induced, or allowed, him to wear. In addition to this, there is the very simple reason, that a writer desirous of referring his readers to a book, is necessarily compelled to make use of the title by which it is known to them.

The publication by Petty of the fifth edition in Graunt's name, appears, certainly, to be a strong fact, but it took place soon after the death of Graunt; and, at that moment, the consideration already referred to would probably have more influence upon Petty's mind than even during the lifetime of his friend.

Professor De Morgan insists strongly upon the difference, both in the style of the *Observations* and in the opinions expressed in them, from the style of Sir William Petty's known writings and the opinions therein to be found. As regards the latter, I do not find any greater discrepancy of opinion than might have occurred in the course of time. On the contrary, some opinions in the *Observations*, regarding pauperism, appear to coincide with the views upon the same subject expressed in Petty's will; and the argument as to style cuts both ways, for the style of the later chapters, particularly of "The Conclusion," appears to me to differ much less from that of Petty's acknowledged works than it does from the style of the earlier parts of the book itself.

I speak with some diffidence of the error in astronomy upon which the learned Professor lays so much stress. I cannot but think, however, that he overrates the knowledge of the science possessed by Petty, who certainly tells us in his will that, at fifteen years of age, he had acquired "the practical geometry and astronomy conducing to navigation, dialling, &c.," but does not appear to have pursued the subject further. Professor De Morgan will, I think, be ready to admit that, at a period preceding by nearly half a century the first publication of Newton's discoveries, a lad of fifteen was not likely to acquire very sound ideas as to theoretical astronomy. Besides, the paragraph objected to stands unaltered in the fifth edition edited by Petty, and the question naturally arises, How came he to publish, as an

editor, that which, it is asserted, he must have known to be so grossly absurd that it is impossible he could have published it as a writer?

The author of the life of Graunt inserted in the *Biographia Britannica*, urges the great improbability of Petty's proposing, or of Graunt's acceding to, such a course as they are said to have adopted. I am quite willing to admit the apparent improbability. The only answer I can give is, that much greater improbabilities have been believed upon much more slender evidence than can be adduced in the present case; and it must be borne in mind that this improbability, as well as all the other considerations cited in support of it, are not more obvious to us than they must have been to the writers who recorded, notwithstanding, that the *Observations* were written by Petty.

If I were disposed to argue the question upon probabilities, I might ask what other evidence Graunt gave of his capacity for writing such a work. The author, whoever he may have been, was undoubtedly a man of genius, who struck out an entirely new path of scientific inquiry, and followed it with such skill as to draw from so competent a judge as Milne the opinion, that, "although his work was the first, it was one of the best" that had been published upon the subject.¹ It is certainly strange, if Graunt were the man, that he should have stopped short after having made such a remarkable step. Of Petty's abilities for dealing with the subject it is unnecessary to speak.

Arguments of the kind we have been considering are, however, of very little value, in my opinion, when compared with the direct testimony of competent witnesses. Burnet has stated positively that the *Observations* were written by Petty,² and in this he is partly confirmed by Anthony à-Wood.³ I do not see why Burnet's evidence should be objected to, as although we may admit that he was credulous and prejudiced, very few persons, I think, would doubt that he honestly believed whatever he reported; and, as an active member of the Royal Society, well acquainted with Petty, he had ample opportunities for ascertaining the truth: still, if his statement were supported by no other writer than Anthony à-Wood, I might hesitate in adopting it without reserve. But Professor De Morgan has overlooked a much more important witness, and one whose evidence I venture to believe would alone be considered decisive. John Evelyn has recorded in his *Diary*, under the date of the 20th January, 1674-5, that he supped at Sir William Petty's "with the Bishop of Salisbury and divers honourable persons." He appears, like most of his contemporaries, to have entertained the highest admiration for Petty, and took the opportunity of making the entry to give an account of him and his works. Among other things, Evelyn says, "He is the author of the ingenious deductions from the bills of mortality which go under the name of Mr. Graunt."⁴

Next to Graunt and Petty themselves, no person in the world was so likely to have known the truth upon this subject as Evelyn. Abundant proof is to be found, both in his *Diary* and elsewhere, that he was intimately acquainted with Petty during the whole of his career; and no person was better informed as to everything that took place in the

¹ *Ency. Brit.*, 7th edition; art. "Mortality."

² *Hist. of his own Times*; Lond., 1833, p. 204.

³ *Ath. Ox.*; Lond., 1818; art. "Sir W. Petty."

⁴ *Diary*; Lond., 1859, ii. 104.

Royal Society. As he died before Burnet's *History* was published, their testimonies are quite independent. Equally independent is the testimony of Anthony à-Wood; and if such evidence is to be rejected, I think there are few facts in history that can be considered as established.

Having stated the case as fairly as I am able, I beg leave, with the greatest respect both to my learned opponent and yourself, to subscribe myself,

Dear Sir,

Your faithful servant,

Camden Hill, W.,
13th June, 1859.

W. B. HODGE.

PROFESSOR SYLVESTER'S LECTURES.

To the Editor of the Assurance Magazine.

SIR,—In some former communications, I have urged upon the consideration of your readers that the doctrine of life contingencies, in place of being based, as for years past, upon specific, and, in many instances, dogmatic assumptions, should rather recognise the results with which it has to deal as essentially variable, and, as such, better predicated for by a system of variation than one of assumptive fixity.

Your readers are aware, that one great step has already been taken in this direction, by the now recognised admission, that, even in the calculations of compound interest, it is not advisable to always assume that the interest upon interest will necessarily be at the same rate as the interest or dividend upon the original capital. The modern actuary is thus not thrust, as the old school were, upon such a generalization as that in $(1+i)^n$ compounded for n years, the value of i must be necessarily constant.

Indeed, you have already inserted tables by Mr. Peter Hardy, involving a mixed rate for annuities certain; and Mr. Willich has illustrated the same principle in life annuities in the new edition, just published, of his excellent *Popular Tables*. Thus, in new Table IV., the value of a life annuity (Carlisle mortality) is, at age 30, 16·37 years' purchase, if the simple interest be 4 per cent., but varies in compounding to 3. It will thus be seen that, even in tables deservedly called "Popular," the change is commencing.

The more particular object, however, of the present communication is to direct the attention of your readers to some discoveries, for so they may be rightly called, of Professor Sylvester, which, I think, will eventually be found to also aid the progress of actuarial calculation—and not the less so because the learned Professor has heretofore been a member of the profession.

The purpose of the discoveries is, I think, sufficiently defined in the following paragraph, which appeared in the *Times* of Saturday, June 10th, 1859, and which I accordingly beg to offer for your insertion, and venture to recommend to the notice of members of the Institute who are still perfecting their mathematical education.

I shall only premise, that, if we pass from a system of special values to one of limits, the partition of numbers becomes, immediately, of the highest importance—the vagueness of an average that does not indicate

from what elements it is derived, depriving it, in many cases, of practical value. But if, by a ready system of partition, not only simple, but compound, we can indicate, within easy limits, the probability of the composition of averages, or numbers considered as such, as a matter of derivation, it will be at once seen that we are afforded a new resource in enforcing the justness of the provisions which an actuary is always, more or less, bound to enunciate, but, as I contend, not necessarily in a specific form.

“Professor Sylvester’s Mathematical Lectures.—On Monday and Thursday last, Professor Sylvester delivered, at King’s College, the first two of a series of lectures on some researches and discoveries which he has recently made in the partitions of numbers. The subject is one which has engaged the attention of the most able analysts—Paoli, De Morgan, Warburton, Herschell, Kirkman, Cayley; but it appears that even they have left a wide field still unexplored. The only problem which these mathematicians had proposed was that of simple partition—namely, to find in how many ways a given number can be composed of given numbers. Their solutions, moreover, are to some extent indirect, and consist in determining a convenient expression from which the required result may be calculated, rather than in actually calculating the result itself. Mr. Sylvester, however, by a direct and elementary process, arrives at the required expression. But, more than this, he proceeds to investigate the problem, never before attacked, of double partition—namely, to find in how many ways can a given pair of numbers, or a couple, as he terms them, be composed of a given set of couples. His method consists of showing that double, triple, and generally compound partition, may be made to depend upon simple partition. Considerable interest was added to the lectures by a happy illustration, derived from a comparison of the problem in question with that of finding the centre of gravity of a system of points; or rather, with the inverse problem of weighting a given system of points so as to be in equilibrium with a given weight at a given point. This mode of illustration lends itself so readily to the subject, that every peculiar case was graphically represented to the audience. We are told, by those who recollect him, that Monge could, by a turn of the wrist and by the shrug of the shoulders peculiar to his nation, render the most complex geometrical figure intelligible to his pupils. We are not aware of any other similar attempt being made in London at expounding in public lectures a very abstruse branch of mathematics; but we may fairly say, that the lecturer’s clear and forcible manner of exposition was perfectly successful, and, if we may judge from the satisfaction expressed by nearly sixty attentive hearers, the verdict was unanimous. The lectures are gratuitous, and are to be continued every Monday and Thursday until the completion of the subject.”

The especial interest I take in the progression of our professional studies must be my excuse for troubling you with this somewhat unusual style of communication.

Your obedient servant,

E. J. FARRREN.

London, June 15th, 1859.

INSTITUTE OF ACTUARIES.

PROCEEDINGS OF THE INSTITUTE.

Fifth Ordinary Meeting, Session 1858-9.—Monday, 28th March, 1859.

W. B. HODGE, Vice-President, in the Chair.

The minutes of the last ordinary meeting were read and confirmed.

The Secretary announced several donations to the library.

Mr. Henry Marshal, duly nominated at the ordinary meeting on the 31st January, was elected a Fellow of the Institute.

Mr. Tucker, Vice-President, read a paper, by Mr. Robert Christie, "On the settlement of losses by fire under specific and average policies, separate and combined."

Sixth Ordinary Meeting, Session 1858-9.—Monday, 2nd May, 1859.

JOHN FINLAISON, President, in the Chair.

The minutes of the last ordinary meeting were read and confirmed.

The Secretary announced various donations to the library.

Mr. Samuel Brown read a paper—"On the mortality amongst American assured lives."

Annual General Meeting, Saturday, 4th June, 1859.

JOHN FINLAISON, President, in the Chair.

The circular convening the meeting having been read,

The minutes of the last ordinary meeting were read and confirmed.

The following Report of the Council on the progress of the Institute during the past year was read, viz. :—

"REPORT OF THE COUNCIL.

"Another year has passed away, and the Council have again to make their Report to the Members as to the progress and present position of the affairs of the Institute.

"Little variation has occurred as regards the number of its Members: on the last occasion, it was stated that there were on the register the names of 45 Fellows, 18 Official Associates, and 81 Associates; at the present time these items are the same, with the exception of the last—the Associates being now 93 in number.

"The state of the finances, and the account of the Institute's receipts and expenditure, will form the subject of a special Report, now in course of preparation; it is, meanwhile, a source of much satisfaction to the Council to be able to state that the proper income of the Institute is abundantly sufficient for its ordinary requirements.

"The following papers have been read during the Session, and have appeared, or will shortly appear, as usual, in the *Journal* of the Institute :—

"1858.

"*November.*—'On the Improvement of Life Contingency Calculation. Part II. The System of Dependent Risks.' By Mr. Farren.

"*December.*—'On the Rates of Interest for the Use of Money in Ancient and Modern Times.' By Mr. Hodge.

"1859.

"January.—'On the Determination of the Rates of Premium for Assurance against Issue.' By Mr. Day.

"February.—'On Fire Insurance: "Specific" and "Average."' By Mr. Miller.

"March.—'On the Settlement of Losses by Fire under Specific and Average Policies.' By Mr. Christie.

"April.—'On the Mortality amongst American Assured Lives.' By Mr. Samuel Brown.

"It was stated, in the last Report, that the Council had determined on applying the interest which had then accrued from Mr. Messenger's legacy, towards the purchase of a prize, to be competed for by the Associates, and to be given for the best essay on a subject which the Council would select. As Members are aware, the subject since selected has reference to the methods of distributing surplus amongst the persons assured in a Life Assurance Company, and the Council hope, in due time, to receive some good essays on this important and interesting inquiry."

Resolved unanimously—

"That the Report be adopted and entered on the minutes."

The election of a President, Vice-Presidents, and Officers, for the year ensuing, was then proceeded with.

Mr. Bishop and Mr. Newbatt were appointed scrutineers of the ballot.

Upon the result of the ballot being obtained, the following was declared to be the list, viz. :—

President.

JOHN FINLAISON.

Vice Presidents.

EDWIN JAMES FARREN.

WILLIAM BARWICK HODGE.

CHARLES JELlicoe.

ROBERT TUCKER.

Treasurer.

JOHN LAURENCE.

Honorary Secretaries.

JOHN REDDISH.

J. HILL WILLIAMS.

Resolved unanimously—

"That the thanks of the meeting be given to the Scrutineers."

"That Mr. Child, Mr. Cutbush, and Mr. Watkins, be elected Auditors for the year ensuing."

A vote of thanks was then passed to the President, and the meeting adjourned to Saturday, the 15th October, 1859.

THE
ASSURANCE MAGAZINE,
AND
JOURNAL
OF THE
INSTITUTE OF ACTUARIES.

On the Casualties to which Contracts of Life Assurance are Liable.

NO greater encouragement can probably be given to the practice of life assurance than the making its contracts as secure as the nature of them will admit, and the rendering as light as possible the consequences of any breach of them. How strongly this is felt by those more immediately interested in the extension of the system may be seen in the constant efforts, more or less legitimate, made by them in this direction. Thus, from more than one quarter the public has the offer of “indisputable” policies, and, from others, “unchallengeable” ones; and Companies are not wanting which liberally enough intimate that they hold, for a considerable time, at the disposal of the assured, the value of the assurance which he has accidentally or intentionally altogether abandoned.

It is curious to observe, on the other hand, that the practice of many Companies is quite opposed to these views; that the conditions under which assurances with them are forfeited are nearly as severe as they were in the olden time; and that these conditions are occasionally enforced with little less rigour now than they were then. As the practice of Life Assurance Companies on these points is of the utmost importance, both as regards their own interests and that of the public, we propose to review, briefly, the conditions under which contracts with them may become liable

to forfeiture—to examine into the justice and propriety of the present practice with regard to them—and to see whether they can, to any extent, be ameliorated without injury to the interests which they are intended to secure.

The first cause of forfeiture which we will notice, then, is, *non-payment of the premium within the stipulated time*. There are still some few Companies, we believe, which would decline to receive a premium, even one day after the term of grace has expired, without proof that the life assured was in good health. Most of them, with such proof, would allow an assurance to be renewed long after the time of its having lapsed; but almost all, we think, would decline, should it appear that the health of the life assured had much deteriorated; so that an assurance, of ever so long standing, may thus be vitiated by one act of negligence. Fortunately, it happens that those who hold policies on their own lives will generally be more careful in illness; but this favourable circumstance does not exist where the life assured, as is very commonly the case, is wholly unknown to the owner of the policy; and instances have arisen under these circumstances, and, no doubt, will continue to arise, in which the assured are placed in a position of considerable hardship. On the other hand, it is well known that a much more liberal construction is put upon such cases than was formerly done, and we believe it is greatly to the interests of the assurers themselves that there should be. It must be remembered that they sustain a very small amount of damage by an irregularity of the kind in question, and are really placed in no worse position when they have condoned it than they would be had none taken place. By not condoning, it is true that an immediate pecuniary advantage may be secured; but it must be borne in mind that no such advantage is contemplated by the constitution of Assurance Companies, and that it must, in the end, be greatly outweighed by the discredit attaching from such incidents to the practice generally of life assurance. These remarks are, of course, inapplicable to such cases of avoidance as arise from the wilful omission to keep up an assurance. Where such intention can be shown to have existed, there is no reason or excuse for condonation.*

The next cause of forfeiture we may draw attention to, is, *an error*

* We may remark here upon the question mooted recently, as to the insisting on payment of the premium within the days of grace notwithstanding the decease of the life assured whilst they are current. We can hardly think that such a stipulation would be seriously insisted on. By the death of the assured the contract and all its formalities are at an end. The sum assured becomes payable, and is held by the directors of the Company for the legal claimant. They have, therefore, the means of paying the premium themselves; and, as it seems to us, have no one but themselves to blame if they do not.

in the declaration. Legally, an error or misstatement in the declaration, though ever so innocently made, is sufficient to vitiate an assurance. Thus, a statement that the age is less than the real one, or the omission of a reference to a medical man who may have attended the life assured in an illness, will be looked upon, in a court of law, as fatal to the contract. Almost all the Companies, we believe, have long ceased to take advantage of unintentional errors of this description, and no great apprehension on this score appears to be felt now by the public. Some modern Companies have announced that no error whatever shall operate prejudicially in this way, but have refused to pay claims on the ground of intentional misstatements notwithstanding—the compact being clearly nugatory, and such an one as by no means commends itself to the good sense of the public, if we may judge by the very limited success with which the promulgation of it appears to have been attended.

A third cause of forfeiture is, *the death of the life assured by suicide, duelling, or the hands of justice.* This condition, we believe, never applies to assurances effected by one person on the life of another. As regards those taken out by an individual on his own life, it is still very generally retained, and that notwithstanding the policy may have been assigned. A great many Offices, however, forego it if the assignment has existed a given time (say six or twelve months) at the date of death; and since it is hardly conceivable that a person can contemplate self-destruction any very long time before committing it, there seems reason to believe that the Companies are abundantly protected by such a clause, and that the public have no reason to complain of it. This cannot be said, however, of those few Companies which make no exemption in the case. The forfeiture of a policy from death happening under such circumstances years after it has been effected, is quite unjustifiable, particularly as the ordinary rates of premium may, as we know, be looked upon as including the risk. What has been said applies, of course, more especially to the act of suicide—the risk arising from death from the other causes mentioned is scarcely, at the present day, deserving of notice.

The last cause of vitiation we have to refer to, is, *the transgression by the life assured of the prescribed limits of travel in time of peace and in time of war.* So far as regards assurances effected by persons on their own lives, there is nothing to object to in connexion with the restrictions which the Offices impose on this score, unless it be in reference to the charge of excessive premiums for the extra risk thus incurred, and we believe there is little ground

of complaint on this head. That the assurance should be vitiated in these cases by a transgression of the limits cannot be considered a hardship, since the assured must be quite aware of the consequences of the step he is taking, and, of course, has it fully in his power to avert them; but where assurances are not of this description, but are such as are effected by one individual on the life of another, the operation of the condition is occasionally severe and untoward. A creditor, for instance, who has insured the life of his debtor, or the mortgagee of a life interest, cannot be ever on the watch to guard against the aberrations of the life they have assured, and hence their security may be wholly vitiated at any time without their knowledge, and they remain in ignorance of the fact until it is too late to apply a remedy. The Offices themselves have felt this to be so great an evil, and so serious a discouragement to the practice of life assurance, that they have sought to mitigate it in several ways. The Scottish Companies, for instance, have intimated their readiness to issue what they call "unchallengeable" policies—that is to say, they will, on application, after an assurance has been in operation five years, expunge the clause in question altogether if it appear that the applicants are acting with good faith, and that there is no likelihood of any immediate transgression of the usual limits by the life assured. There seems to be no good reason for selecting this particular term of five years; but probably it has been thought that it suffices to give a good knowledge of the character of the parties, and that the directors would be enabled, at the expiration of such a period, to determine with tolerable certainty whether such an exemption might be safely allowed. It will be observed, however, that there is no certainty in the outset that the exemption will be granted; and that, in any case, it affords no protection during the first five years.

Another device resorted to for the purpose in question is the granting what is called a "whole world licence," in consideration of an extra premium, usually payable as long as the ordinary one, and varying from five shillings to five pounds per cent. This is a practice adopted by most of the Offices, and is, no doubt, effectual in its operation. The objection to it is its expensiveness—we know of no other. A third method is the allowing an endorsement to be placed on the policy, such as that quoted at page 27 of this volume.*

* "It is hereby agreed, that, should the within-named A. B. go, without licence, beyond the limits prescribed by this policy, this assurance shall, nevertheless, remain in full force and effect, provided the assured, or his representatives, shall, within fourteen days of such event coming to his knowledge, pay the additional premium usually required for the risk incurred."

This is probably as simple and effectual a safeguard to the assured as can, under the circumstances, be devised. No expense is incurred unless an extra risk be actually entered upon, and the risk is not in effect regarded as one till the assured has become cognisant of it. An endorsement of this description, it is true, is not allowed as a matter of course; indeed, it has, as yet, for the most part, been confined to such assurances as are made by one Life Assurance Company with another; but we believe the practice of allowing it is gradually extending to ordinary cases, and that, if asked for, no objection would be made generally to the grant of it; since it is obvious that, were the intentions of the assured of a fraudulent character, very little advantage would accrue to him from the concession. In short, the merit of the arrangement consists in its affording material security to the policy-holder, whilst it throws little or no additional burden on the Company.

From what has been said, it will, we think, be seen that the casualties to which the assured are liable are not very serious if the management of a Company be of a liberal and considerate character: where this is not the case, they become of greater importance. The tendency at the present time, however, is undoubtedly in the right direction; and, as a much more intimate intercourse now obtains between the Assurance Companies than was the case formerly, it is probable that no such instances of oppression and hardship as have heretofore frightened policy-holders and everybody else from their propriety, will again be heard of.

That there is more ground for this assertion than at first might be admitted, will be acknowledged when the proceedings of our friends in the United States are generally known. There, efforts are making which, in liberality and consideration for the assured, are, perhaps, in advance of the ideas commonly prevailing here. We have been favoured by Mr. Elizur Wright, one of the Insurance Commissioners of the Commonwealth of Massachusetts, with the following project of law advocated by them before the Joint Standing Committee on Mercantile Affairs and Insurance. It is in two sections, which run as follows:—

“SECTION 1.—No policy of insurance on life hereafter issued by any Company chartered by the authority of this Commonwealth shall be forfeited or become void by the nonpayment of premium thereon, any further than regards the right of the party insured therein to have it continued in force beyond a certain period, to be determined as follows, to wit:—The net value of the policy, when the premium becomes due and is not paid, shall be ascertained according to the ‘combined experience’ or ‘actuaries’”

rate of mortality, with interest at four per centum per annum. Four-fifths of such net value shall be considered as a net single premium of temporary insurance; and the term for which it will insure shall be determined according to the age of the party at the time of the lapse of premium, and the assumptions of mortality and interest aforesaid.

“SECTION 2.—If the death of the party should occur within the term of temporary insurance covered by the value of the policy, as determined in the previous section, the Company shall be bound to pay the amount of the policy the same as if there had been no lapse of premium, anything in the policy to the contrary notwithstanding.”

On these the Commissioners remark :—

“This was resisted on behalf of the Life Insurance Companies, on account, among other reasons, of the alleged difficulty of determining the amount of insurance due under it on lapsed policies, although there is no greater difficulty in the case than attends any other question in life insurance.

“Granting the certainty of a given law of mortality in its application to the business of a Life Insurance Company as a whole, and a constant rate of annual interest on investments, it becomes possible to assign a value to any individual pecuniary risk. The usual case of life insurance is, that the Company agrees to pay a certain sum at the death of the insured, in consideration of a constant or invariable annual payment during the life. But, inasmuch as the chance of the death occurring in any particular year of the possible life increases with the age (though not *as* the age), the annual payment or premium must be more than sufficient to pay for the year's insurance in each of a number of the first years, in order that the excess, with its compound interest, may make up the deficiency on the last years. The accumulation of the annual excesses, at compound interest, constitutes the value of the policy, which is substantially so much of advance payment by the insured, on that part of the contract which is yet to be fulfilled by the party of the other part. If at any time the Company should be relieved from further risk, it seems equitable that it should restore to the insured the advance payment, or value of the policy. It is to be remembered that the insured, while his policy was in force, contributed his full share to pay the losses which occurred during that period. Hence, the Company cannot lose by his surrendering the policy, and withdrawing its value, unless we are to suppose that his vitality is more likely to be above than below the average, or law. Plainly, if the sounder lives should withdraw, *and not be replaced by others equally sound*, the basis on which the premiums were calculated would be disturbed, and the Company, with an experience of mortality greater than that of the law, would ultimately find its means insufficient to meet its liabilities. But if the business of the Company is kept good, by the accession of sound lives (and every Company is careful not to take any others without a compensating enhancement of premium), it is not easy to see how there can be any danger in allowing any one, who chooses at any time to do so, to cease paying premiums, and withdraw the entire value of his policy. In actual practice, the presumption that only the sounder lives will wish to surrender is not considered as a good reason for withholding more than one-quarter or one-third of the value of the policy. From 66 to 75 per cent. of the value is paid to the healthiest, if the application to surrender is made while the policy is in force. Yet it has been the uniform practice in this country, and, till very lately, in Great

Britain, to make the whole value of the policy, as well as the right to further insurance, the forfeit of a failure to pay the annual premium on a specified day. Failure to pay premiums may arise, not only from confidence of long life, but from misfortune, imbecility of mind, preoccupation or unavoidable detention. Hence the class of lapsed policies may embrace cases below as well as above the average vitality of the Company, and, consequently, there is less reason to justify the Company in withholding the whole or a part of the value from the holders of lapsed policies than from the holders of policies in force who wish to surrender. But, when we carefully consider how the *sense* of vitality fails to correspond to the actual fact, and how much more likely the subjects of some of the most destructive maladies are to indulge in visions of longevity than the tenants of sounder constitutions, we can hardly believe that the average vitality of the holders of lapsed policies ever has been, or ever will be, appreciably above the average vitality of those who remain. If so, the resources of a Company would not be impaired if it were required to give the holder of a lapsed policy insurance to the full amount thereof, for such further term as the value of the policy at the date of the lapse would be sufficient to pay, due allowance being made for the expenses of the Company.

"In the following table, applicable only to whole life policies on which the premium is payable annually, the value of the policy is regarded as a gross single premium for a temporary insurance, that is to say, a premium which is 25 per cent. larger than the net or mathematical premium, for the sake of providing for expenses and adverse contingencies. The object of the table is, to give, in years and days, the additional term for which such premium will pay for insuring the sum named in the policy on the same life. It embraces policies taken at any age from 10 to 69 inclusive, and extends to 40 premiums paid. Its use will readily appear from an example. Suppose a person who took a policy at the age of 25 has paid 26 premiums upon it, and has failed to pay the 27th when due. If we find the age of 25 at the top of the table, and look beneath it against the number 26, we shall find 14 years and 146 days. This is the term for which the value of his policy at the time of the lapse is a sufficient single premium for insuring the amount of the policy. To explain a little, the value of his policy at the date of the lapse was 29.91 dollars per cent. of its amount. The net cost of insuring 100 dollars on his life at his present age of 51, for 14 years and 146 days, is 23.93 dollars. Adding one-fourth, or 5.98 dollars, for expenses, &c., we have 29.91 dollars, which is the value of his policy. And why not give him all the insurance he has paid for? Taking lives just as they rise, or at random, any American Company would be doing rather better than it is now doing, by insuring at this rate. If it be true that the sounder lives would suffer their policies to lapse, under a law requiring the Companies to pay the sums insured in case of deaths occurring within the times given in this table, so much the better for the Companies than if the lives were worse. True, the Companies would lose the large profit that now arises from the forfeiture of the value, but that is a profit of pure gambling—a sort of profit from which, in other cases, the law has withdrawn its protection."

We do not give the table above referred to, as the nature of it will be readily understood from the explanation afforded by the Commissioners, and as it would scarcely suit the Offices here were

such a system adopted. We quite concur in the fairness of the proposition made by those gentlemen, and think it does them credit, as does also the ingenuity with which the plan is carried out. But it seems open to the objection, that disputes might arise, in particular cases, as to the precise term covered by the value of the policy, and whether a death happened within the term or not—since claims might be made long after the term expired. Were this objection satisfactorily got over, it appears to us that the arrangement is just and reasonable, and might be properly carried into effect; otherwise we should prefer the practice referred to at the commencement of these observations—viz., the retention for the assured of the value of his assurance for a certain number of years after its lapse; but, better than either of these plans, we should consider that mode of acting, which, when a lapse occurred, inquired into the causes of it, and freely co-operated in the restoration of the assurance, whenever it was found that such restoration was desired.—ED. A. M.

*Treatise on the Medical Estimate of Life for Life Assurance.**

THE principal circumstances affecting the value of individual life, have reference to sex, age, personal peculiarities, habits, occupation, residence, family history, previous ailments, and present health. These are brought before the medical referee, in the printed forms of examination and inquiry adopted by Life Assurance Societies, in a series of questions calculated to elicit the information required. In the present treatise they will be considered under several heads.

Of sex, as affecting life, but little need be said. The slight difference in favour of the female is not of practical moment, and the peculiar functions and liabilities of this sex will be noticed subsequently.

Age.—The medical referee has nothing to do with the actual proof of age, but only to remember that it is relative rather than positive; and that some persons, from inherent weakness of constitution, bad habits, or other exhausting causes, grow old before the age of forty, while others, far advanced in years, are virtually young as regards effective performance of function and vigour of constitution. Where any great discrepancy exists between the real age and that apparent in the aspect, gait, and force, it will be

* Extracted from the *American Life Assurance Magazine and Journal of Actuaries*; a periodical which promises to be of great interest and utility in the life assurance world. It is edited by G. E. Currie, Esq., U.S.—ED. A. M.

necessary to ascertain, if possible, the cause of such ; or, at any rate, to conduct a more searching examination as to health and habits.

Medical men are well aware of the liability of different periods of life to particular diseases. No general conviction can, however, equal the certainty afforded by statistical facts when based upon sufficiently extensive materials. Mr. Neison, in an analysis of the mortality of the provident classes in this country and upon the continent, based upon facts furnished by the records of the Gotha Life Society, shows that, "in the decennial period, 31 to 40, the greatest rate of mortality has taken place from pulmonary diseases; next, from fevers; then from local inflammations, abdominal diseases, apoplexy; and, last of all, from dropsy; and the next ten years of life the mortality of these diseases follows the same order as to their intensity. In the term of life 51 to 60, however, the following is the order in which the same six diseases stand as to intensity:—apoplexy, fever, pulmonary diseases, inflammation, dropsy, and abdominal diseases. And, in the next ten years, the order is again varied, being apoplexy, inflammation, abdominal diseases, dropsy, and fever equal, and pulmonary diseases at the bottom of the scale; and, in the more advanced term of life of the preceding abstract, the following is the order of the intensity of the diseases:—apoplexy, inflammation, fever, abdominal diseases, dropsy, and pulmonary diseases." It appears, therefore, that, so far as the above facts are concerned, pulmonary disease is the disease "of highest intensity in the destruction of life under 50; and, above that age, apoplexy—the other diseases maintaining varying but intermediate positions in the scale of mortality."

Mr. Neison says, that the generally-received opinion as to the insecurity attending risks upon the lives of old persons is shown by statistical evidence to be fallacious; and he observes, that, on an attentive consideration of the doctrine of probabilities, it must be clear, that, in guaranteeing any event connected with the law of averages, the nearer to unity the chances of the contingency taking place be, the less the hazard of any adventure on the result. Dr. Christison, on the other hand (and most medical men who have had any experience in the subject will agree with him), complains of the insecurity attending risks accepted after the age of 60, and considers it due, in a great measure, to the fact that the prevailing causes of death among the aged are of a kind which it is very difficult to anticipate, even on applying the most approved principles of examination. It is advisable, as a general rule, not to accept aged lives unless they are, in all respects, of first-class character.

The medical referee should bear in mind those periods in human life to which the term *climacterics* has been applied. It is the "grand climacteric," as it has been termed—the "cycle closing," as the Chinese call it—which occurs at 60 or a little later, that presents most interest in a life assurance point of view. This period is frequently marked by a change for the worse—a sort of decline without special disease—so that any illnesses, or frequent slight ailments, or mere general flagging of power and delicacy of system, occurring about this period, should be looked upon with suspicion.

The married or single state of the party proposing is not altogether immaterial. The liabilities affecting the female in either state will be discussed hereafter. For men whose lives have been somewhat irregular, or habits objectionable, a change from the single to the married state may be looked upon as advantageous. For some, however, especially for those who are deficient in vigour, the early months of marriage may prove trying to the constitution; and, as a large number of assurances are effected either shortly before or after entering into matrimonial alliance, it will be well not to lose sight of this consideration.

Personal peculiarities.—The general external features next come under observation. When the *temperament* of the individual is broadly pronounced, it should be stated which of the following he exhibits:—

1. The sanguine temperament, characterised by preponderance of the circulatory system, as shown in the ruddy hue of the face, the general injection of capillaries, the volume of heart and lungs, the richness of blood, and evident high vitality; by its tendency to plethora, congestions, and inflammatory affections, counterbalanced, however, by great reparative power.

2. The lymphatic temperament, characterised by slowness of circulatory and nervous systems, fair hair, and light eyes, pale flabby aspect, deficient muscular tone and functional energy; by its proneness to lymphatic and glandular affections, and weak reparative power.

3. The bilious temperament, pronounced in the dark, sallow, or yellowish aspect, black or brown hair, large bushy beard and eyebrows, firmness and prominence of muscular system, and scarcity of fat; by its tendency to hepatic affections, hypochondriasis, &c.

4. The nervous temperament, distinguished by preponderance of nervous system as exhibited in the large brain and expressive eye, by sensitiveness and impressibility, by its power of developing

intense energy under emergency, and incapability of sustained force and action.

In all cases, it is important to note whether the *configuration* of the party be good and symmetrical, or otherwise; the relation of breadth to height, the breadth or narrowness of shoulders, the depth and capacity of chest, the slimness or squareness of figure, and the general aspect and form as expressive of powers of resistance or the contrary.

It is requisite also to state whether the *habit of body* be full or spare. Excessive spareness, amounting to emaciation, should excite suspicion, as indicating some constitutional malady which either involves constant loss of material or interferes with nutrition. Where such emaciation is accompanied with evident want of power, the life should be declined, even though no disease is to be detected. Great obesity must also be looked upon as an unsatisfactory feature, especially in comparatively young persons. Very corpulent people are usually high livers, and take but little exercise. They are, in other respects, bad lives: the fat in the abdomen interferes with the action of the diaphragm and the effective expansion of the lungs, and causes shortness of breath, either constant or induced by trifling exertion; fat becomes deposited about the different viscera, and impairs their functions; it accumulates around the heart and in its tissue, and sometimes takes the place of this; while the general mass impedes free movement and interferes with the exercise necessary to health. Fat people, moreover, exhibit but little power of resistance when overtaken by disease.

The medical referee must next notice whether the *complexion* be clear, pale, ruddy, dusky, or sallow; he must also mark the colour of the hair and eyes; and, in short, endeavour to give in terse, graphic language, an accurate description of the individual, who, like the immortal Pickwick in the Fleet, though under different circumstances, is sitting for his portrait.

If the *aspect be indicative of tendency to any particular disease*, such must be noticed. The medical man will bear in mind the characteristic aspect of certain constitutional maladies.

The scrofulous aspect exhibits itself in pallor of countenance, with transient flush of the cheeks, a tumid state of the lips, especially of the upper, slight glandular swellings in the neck, a flabby state of the muscles, narrowness or malformation of chest, rapid increase in height, with deficient lateral development, rather than in any distinctive complexion, such as that expressed in flaxen

hair, large blue eyes with long eyelashes, &c., which is now known not to be associated with greater liability to such disease than the complexion of quite an opposite character.

The cancerous aspect is seldom marked unless the disease is already developed, and then may show itself in sallowness or pallor of face, or general clayey hue of the skin, and peculiar sadness of expression. The anæmic, chlorotic aspect of females suffering from uterine derangement, the short neck and plethoric aspect of the apoplectic subject, and the characteristic appearance of the bilious and dyspeptic, will not escape the observation of the medical examiner.

Dr. Brinton notices the streaky, capillary congestion, which gives to the middle of the cheek a peculiar mottled appearance, and which, when contrasted with great pallor of the skin generally, and especially of the surrounding integuments, is generally, he considers, associated with albuminous condition of the urine.

Habits of a morbid or disease-engendering nature, form an important item in the medical estimate of life. Of such habits the one of most moment is intemperance, or habitual excessive indulgence in the use of spirituous liquors. At times, the history, previous ailments, or aspect of the party, speak openly as to the existence of such habit; at others, it will require all the tact and powers of observation of the medical referee to detect it. No mere positive assurance of the party, as to his sobriety, should satisfy, as it is obviously his interest, if not to deceive, at least to make light of his propensities; or, if he do not evade giving a direct answer to queries proposed, his views as to what constitutes temperance may be vastly different from those of his examiner. It will, therefore, be advisable, if any doubt exist upon the matter, to subject him cautiously, and with apparent indifference of manner, to a series of questions, in order to elicit information as to the quantity and nature of the spirituous liquor which he imbibes—whether he is in the habit of drinking between meals upon an empty stomach, and whether or not his occupation peculiarly exposes him to temptation. Where the means of the party are independent, the inquiry into habits becomes of paramount importance. At the head office of a Society, information as to habits, which may escape the medical referee, is often obtained through the agent, private friend, or private medical attendant.

The practised eye of the medical examiner will at once detect the advanced drunkard in the characteristic bloated countenance. His experience, too, will recall the legion of evils which the spirit

drinker entails upon himself, and through which he exposes himself to premature old age and death. Of these evils may be noticed, first, the effects upon the stomach, which is primarily exposed to the baneful influence, and the mucous membrane of which becomes the seat of chronic inflammation, with attendant loss of appetite, rejection of solid food, and consequent imperfect nutrition and emaciation; secondly, disorders of the liver, either in the shape of cirrhosis, which is, sooner or later, inevitably fatal, or of portal congestion, with concomitant oppression of abdominal viscera; effects upon the circulation, in the form of congestions of the capillary vessels of the skin, exhibited in boils and carbuncles, and of irregular action of heart, and even disease of this organ; and, lastly, various effects upon the nervous system, resulting from its alternate excitement and depression and undue stimulation of the nervous centres, and developing themselves in apoplexy, delirium tremens, permanent insanity, or temporary fits of madness, in which the drunkard does violence either to himself or to others. It is calculated, that, of the cases of mania occurring among the lower classes, at least 15 per cent. are traceable to this cause; while of those occurring in the middle classes, about 10 per cent. have this origin. The medical referee will also bear in mind, that one of the consequences of habitual excess is a diminished power of bearing up against the shocks to which the frame is at all times liable. This is particularly observable in brewers' and distillers' draymen, in coalheavers and others, who, though—from constant muscular exertion and taking regularly a good supply of food—a well-developed set of men, yet, from habitual sotting, have a wonderfully low degree of vital force, and frequently fall victims to a mere scratch. This class of men, as well as others in higher station—as licensed victuallers, drivers, commercial travellers, &c.—who are given to habitual excess in drinking, are the first to fall victims to the passing epidemic or to the disease of the locality or climate in which they may be placed, and to bring into play hereditary predisposition in the shape of consumption, gout, rheumatism, apoplexy, or insanity. They are also frequently cut short in their career by fatal accidents met with when under the influence of liquor.

Mr. Neison, in a paper in the *Journal of the Statistical Society* for 1851, exhibits this habit in relation to life assurance, in a series of tables based upon carefully-accumulated material. From an analysis of these tables, he shows that an intemperate person, of age 20, has an equal chance of living 15·6 years more; while a

person of the general population of the country, of the same age, has an equal chance of living 44·2 years. Again: at age 30 the intemperate person has an equal chance of 13·8 years, and the other 36·5 years; at age 40 the chance of the one is 11·5 years, and of the other 28·8 years. He also, by an analysis of the returns of the Registrar-General, shows that, while diseases from other causes exhibit a falling short in intemperate lives as compared with the population generally, the diseases of the nervous system and digestive organs form 15·95 per cent. of the deaths from all causes at corresponding ages, but among intemperate persons they form 50·4 per cent. of all the deaths which take place—exceeding the general average more than three times. He concludes, therefore, that these diseases may be taken as the distinctive type of the causes of death among intemperate persons. Mr. Neison also demonstrates that the maximum rate of mortality in intemperate lives is at the age of 41 to 50, and that drinking habits are then most prevalent and confirmed. He further calculates that there is one drunkard to every 74 of the male population above the age of 20, one to every 434 of the female population, and one to every 145 of both sexes above the age of 20. Where any doubt exists as to habits, especially in an individual exposed by occupation to intemperance, the life should be unhesitatingly declined. It must be remembered that this vice seems apt to run in families; or, in other words, that at times the propensity to intemperance would appear to be an inheritance. As a rule, reformed drunkards are bad lives.

Habitual gormandising, or excess in the use of animal food, induces an undue quantity and richness of the blood, and predisposes to inflammatory and congestive affections, especially of the abdominal viscera. It is especially serious when coupled with want of exercise and a sanguine temperament or plethoric habit of body.

The habit of smoking tobacco, which has recently been the subject of so much illogical argument, deserves a passing notice. There is no evidence whatever to show that this practice, when had recourse to in moderation, and not complicated with spirit drinking, at all tends to shorten the duration of life. Addiction to it in great excess may doubtless induce dyspepsia, nervous affections, possibly paralysis, certainly delirium tremens.

Inquiry may be made—although the answer will, in many cases, be involved in the occupation—as to whether proposer's habits are sedentary or otherwise. The beneficial effects of efficient daily exercise are shown in increased vigour of circulation—

in the promotion of nutrition and the various excretory functions—the want of such being exhibited in the converse. Sedentary habits are especially objectionable in those who are disposed to corpulency or plethora, or who have inherited some constitutional malady.

Occupation.—As life assurance is no longer confined to the better class of tradesmen, to master manufacturers and professional men, but is now appreciated and had recourse to by the more intelligent and provident artisans of all classes, it becomes important to determine whether any, and what, peculiar risk is involved in particular occupations. It is, however, much to be regretted, that, with the exception of the Registrar-General's summary of certain years, and his deductions therefrom, and a recent report by Dr. Letheby, there are no satisfactory statistical tables exhibiting the relative mortality of different occupations. One has, therefore, to rely chiefly upon different independent sources for facts bearing upon the healthiness of trades and professions. Before entering upon the special consideration of them, it may be stated that there are but few occupations which, in themselves, exercise so prejudicial an influence on life as to render the risk unusually hazardous, and, consequently, that the occupation of the party must be taken in connection with other considerations affecting his life.

The Registrar-General, in the preface to his *Report for 1851*, exhibits the relative mortality of different occupations as compared with that for all England in the following table:—

Occupation.	Mortality per Cent. at Age					
	25-	35-	45-	55-	65-	75-
Farmer	1·015	·864	1·199	2·490	5·530	14·802
Shoemaker	·912	1·059	1·503	2·869	6·505	16·446
Weaver	·797	1·056	1·537	3·299	7·459	17·308
Grocer	·763	1·046	1·579	2·265	4·972	12·457
Blacksmith	·812	1·240	1·651	3·724	6·443	16·710
Carpenter	·945	1·032	1·667	2·966	6·586	14·286
Tailor	1·163	1·415	1·674	2·818	7·647	15·528
Labourer	·979	1·252	1·730	2·920	6·790	17·394
Miner	·849	1·135	2·015	3·450	8·051	17·867
Baker	·759	1·475	2·121	3·301	6·678	15·066
Butcher	1·130	1·653	2·310	4·149	5·647	15·449
Innkeeper	1·383	2·045	2·834	3·897	8·151	18·084
All England	·948	1·236	1·787	3·031	6·396	14·055

It appears, from the above, that the highest mortality is exhibited by licensed victuallers; the next degree, curiously enough,

by butchers; while farmers are at the head of the scale in point of health and longevity. Dr. Letheby's *Report on the Sanitary Condition of the City of London for 1855-6*, presents a somewhat different result. "The expectancy of life," he says, "among young men generally, at 20 years, is up to 60. You will perceive that this is nearly the expectancy in London with shopkeepers and domestic servants, for the mean age at which they die is 58·8 and 58·6. Butchers, poulterers, and fishmongers, live to the age of 53·8; carpenters, cabinet makers, and workmen in wood, to 52·4; clerks, accountants, porters, and messengers, reach from the age of 52 to 52·3. The same is about the mean age at death of blacksmiths, gasfitters, and the workers in the coarse metals generally; while publicans, wine merchants, waiters, tailors, labourers, and shoemakers, live to the age of from 49·9 to 50·3. Cabmen, carmen, ostlers, and draymen, live only to 49·4; and soldiers, sailors, and policemen, reach only to 48 years. A like difference exists in the longevity of females; for, while the wife of the shopkeeper will live to be about 57 years of age, and the domestic servant to 51·5, the wife of the publican and beer-shop keeper, and the wife of the cabman and ostler, will only reach to 44·2 and 48 years of age; and, worse still, the poor needlewoman sinks into the grave at 42·6 years of age."*

In reference to their effects upon health and longevity, different occupations may be arranged and considered under the following heads:—

1. *Aristocracy, gentry, and men of independent means*.—The inquiries of Dr. Guy show, that, while expectation of life for males of England and Wales, at 20 years of age, is over 40 years or beyond the age of 60, that of the nobility is only 38·6, and that a corresponding ratio is maintained at every succeeding decennial period. In analysing the matter more closely, it would appear that, in point of health and longevity, the aristocracy fall far short of the agriculturist, and below the several professions. The cause of this is to be found, Dr. Guy thinks, in habits of self-indulgence, and the want of incentives to that exertion which tends so much to promote health and vigour. Among men of independent means are to be found those who are given to indulgences of the table, to excess in drinking, and to other kinds of dissipation; hence, with them, the inquiry into habits becomes of considerable moment. On the other hand, the wealthy classes are not harassed by the

* These mean ages, and some of those which follow, appear to be derived from the deaths merely.—ED. A. M.

mental anxiety and bodily toil which attend the thinkers and workers of the community; and, when not addicted to those habits to which they are tempted by ample means, may be looked upon as good average lives.

2. *Members of the various professions, literary men, philosophers, and those devoted to the fine arts.*—Casper, of Berlin, has calculated that the age of 70 years is attained by 42 theologians in 100, by 29 advocates, by 28 artists, by 27 instructors and professors, and by 24 medical men. Mr. Madden, in comparing the mean life of celebrated men of different classes, has found that of naturalists to be 75 years; of philosophers, sculptors, and painters, 70; of lawyers, 69; of doctors, 68; theologians, 67. To such calculations as the above, however—considering the limited range of facts on which they are based, it will be well not to attach undue weight. In the more active intellectual professions, there would seem to be that happy balance of physical and mental exertion which is most conducive to health and vigour both of body and mind.

With the lives of medical men, especially of general practitioners, who, according to Dr. Guy, exhibit a lower expectancy than physicians or surgeons, there is associated much anxiety, frequent loss of rest, exposure, and, at times, great risk of succumbing to contagion. Of 54 deaths from fever in Dr. Begbie's analysis of emerged risks of the Scottish Widows' Fund, one-sixth part occurred in members of the medical profession—an experience which justifies, he observes, the caution exercised by his board when called on to consider the proposal of medical men who have not previously passed through the disease. Dr. Christison feels quite as strongly upon this point:—"In the medical, and all other professions necessarily much exposed to contagion in large towns, it should be made a condition of acceptance that the proposer has either already had typhus, or has been freely exposed without taking it. In Edinburgh there are few medical men of the age at which insurances are effected who are not thus qualified." Partly to such exposure, though even more to the first effects of climates, may be attributed the high rate of mortality among the younger members of the medical department of the army, as compared with the older and well-seasoned members.

Clergymen, in general, do not take sufficient exercise; and, consequently, often suffer from dyspepsia, hepatic derangement, congestion of the venous system of the bowels, hæmorrhoids, &c.; sometimes, also, in the prosecution of their duty, from contagion. Lawyers, also, suffer from sedentary habits, and from over-straining

the mind. Civil engineers, surveyors and architects, pursue, in most respects, a decidedly healthy occupation.

In artists, poets, musicians and others, in whom the imagination is much called into play, one has to dread the extravagances of this faculty, and their leading on to mental aberration.

The sedentary habits of philosophers and students frequently induce the consequences already indicated as likely to arise from such, while mental tension and excitement occasionally result in mania. In the various classes of intellectual workers, the effects depend not merely on individual mental capacity and energy, or upon sustained application, but on the predominance of repose or excitability in the constitution, and the habitual joyousness or gloom of individual character. "The position of the student," remarks Thackrah, "is obviously bad. Leaning forward, he keeps most of the muscles wholly inactive; breathes imperfectly, and often irregularly, and takes a full inspiration only when he sighs. He generally lives, too, in an impure atmosphere, and neglects the common means of relief. The circulation is enfeebled, the feet become cold. The appetite is less frequently reduced than we should expect—often, indeed, it is too great; but, whether moderate or excessive, it is greater than the power of digestion; for the application of mind, too great or too long, absorbs the nervous energy which digestion requires. The stomach becomes foul, the secretion of bile is impaired or vitiated, the bowels are sluggish, and constipation, with its attendant evils, progressively succeeds. As sanguification is imperfect, nutrition is imperfect, and the body either wastes or becomes plethoric with impure blood. The brain becomes disturbed. Congestion first occurs, and to this succeeds an irregular or increased action of the arteries. A highly excitable state of the nervous system is not unfrequently produced."

3. *Merchants, and others engaged in hazardous speculations*, are constantly in a high state of mental tension, and are said to exhibit a larger proportion of insanity than any other class. People who are engaged in extensive business are apt to take their meals hurriedly, and hence suffer from dyspepsia, gastric disorders, and hepatic derangement. The dealers and shopkeepers of thirty years ago are depicted by Thackrah as leading a lamentably unnatural mode of existence—shut up from morning to midnight in their shops or little back parlours, without free light or air, effective exercise, &c., and with their minds concentrated on the state of the till. At the present day, the better class of shopkeepers, especially in the metropolis, avail themselves of the ap-

pliances and means afforded of leading a more sanitary kind of existence.

4. *Out-of-door occupations.*—The inhalation of pure air, good exercise, early rising and going to bed, simple diet, and, in general, temperance, insure for husbandmen and agriculturists a higher longevity than is attained by any other class. It is calculated that, while in the manufacturing districts the mortality is 1 in every 53, in the agricultural it is only 1 in 67. Exception must be made of inhabitants of fens and marshes, who are subject to repeated severe ague attacks, and consequent lesions of abdominal viscera.

Under this head may be considered soldiers and sailors. The mortality of soldiers, even in times of peace, and when they are on home stations, exceeds that of the general population, being, for Great Britain, upwards of 15 in every 1,000. When they are on foreign stations other causes come into operation, as nostalgia, unhealthy sites, over-crowding and filthiness of barracks, fatigue and exposure to weather and peculiar local diseases, deficient quantity and bad quality of food. The mortality among soldiers abroad varies, of course, with the station.

According to official documents, the proportion of deaths during a period of 20 years, from 1817 to 1836, in every 1,000 effective men, was as follows:—

55·2	.	.	.	.	.	in Ceylon.
63	.	.	.	.	.	Bengal.
85	.	.	.	.	.	Antilles.
143	.	.	.	.	.	Jamaica.
200	.	.	.	.	.	Bahama.
483	.	.	.	.	.	Sierra Leone.

Since the introduction of improved dietetic and other arrangements into the navy and merchant service, the mortality of seamen has immensely diminished. Risks from accidents at sea and shipwreck, and exposure to the morbid influences of different climates, still, however, operate in keeping up the mortality of this class. From materials derived from the records of the Master Mariners' Society, Mr. Neison arrives at the following results:—"Of 270 deaths, 165 only have taken place from natural causes, the others from shipwreck and accidents connected with the occupation. The above 270 deaths exhibit an increase compared with the average mortality of the male population of England and Wales, of upwards of 86 per cent.; or, looking only at the 165 deaths from natural causes, a difference of 14·5 per cent."

5. *Occupations which impregnate the atmosphere with—*

(1) *Dust*, as in the case of masons, cutlers, grinders, marble workers, steel and iron workers, fork grinders, needle makers, workers in ivory, bone, or mother-of-pearl—in silk, wool, and flax, corn millers, colliers, &c. In all these occupations the danger arises from the fine dust, which is given off, entering the air tubes and setting up disease, which gradually increases in severity, and ultimately proves fatal. M. Lévy graphically describes the gradual development of cotton phthisis, as it is called—the dryness of mouth and throat, then the cough, which becomes more and more troublesome, until the disease, though essentially chronic bronchitis, takes on the appearance of phthisis pulmonalis, with copious expectoration, hectic wasting, and the fatal termination. “The inhalation of coarse particles,” says Lewis, “is less dangerous than that of dusts finely divided, which penetrate more easily into the last ramifications of the air cells. The researches of Benoiston and Lombard have proved that sculptors, masons, plasterers, excavators, hatters, brush makers, harness makers, mattress makers, &c., furnish fewer consumptive cases than millers, wig makers, paviors, sweepers of streets, charcoal dealers, bakers, cutlers, chimney sweeps, polishers, &c. Dusts from hard substances cause a much greater number of consumptive cases than dusts from soft bodies or of ordinary hardness. Under the consideration of their origin, mineral dusts are the most noxious to the lungs, then follow animal dusts, and, lastly, vegetable.”

We must not confound with the dust-evolving occupations those of wet grinders and knife grinders, where the stone is wet, and, consequently, little or no dust is given off.

(2) *Emanations*, either of an animal character, as in the case of curriers, catgut workers, &c., which are not attended with any material injury to health; of a vegetable character, as in tobacco manufacturers, who suffer inconveniences at first, but gradually, in great measure, surmount the ill effects produced by the effluvia; and, lastly, emanations of a mineral nature, as from lead, arsenic, phosphorus, mercury and zinc, in the trades of plumbers, white-lead manufacturers, painters, paint and paper makers, potters, lucifer-match makers, looking-glass silverers, gilt button makers, water gilders, brass founders, &c. The effects of lead upon those exposed to its absorption by the lungs and skin, as in the first five of the occupations just noticed, are well known: the blue line on the gums, the colic, the local palsy, the affection at last of the nervous centres, the general anæsthesia, and, perhaps, palsy of motor power;

the subsequent convulsions and coma, followed by death. The effects of phosphoric emanations—the necrosis of jaw and bronchial irritation—are serious, but do not very materially affect the value of life. The effects of inhalation of mercurial vapour in looking-glass silverers, water gilders, &c., are seen in the ultimate debility, tremors, and palsy, to say nothing of the usual characteristic signs. The organs of respiration are much affected by the evolutions of oxide of zinc vapour in the founding of yellow brass.

Stovers of straw bonnets, and bleachers of worsted, suffer from sulphurous acid fumes, which cause difficulty of breathing, cough, and development of pulmonary disease, especially where the tendency to such exists.

Miners may be considered under this head, as inhaling an atmosphere impregnated with dusts and emanations, although their health is injured by other causes, as by working in a stooping posture, exposure to wet, and deficiency of light. They are not, however, very likely subjects for life assurance.

6. *Occupations involving peculiar and constrained posture, and carried on generally in a confined atmosphere*, as in the case of clerks, schoolmasters, tailors, shoemakers, watchmakers, carpenters, weavers, engravers, milliners, &c.

Clerks, including bookkeepers and accountants, bend much over desks, sometimes press their chests against these, and, at any rate, from their stooping posture, prevent the effective action of the lungs and digestive organs, and suffer from indigestion and indolence of the liver; and, when predisposed, from lung affections. The occupations of the tailor and shoemaker leave their indelible marks in characteristic deformities of the chest. This, in the tailor, is depressed immediately below the ensiform cartilage; and, in the shoemaker, presents a sinking in at the level of the chondro-sternal cartilages of the sixth, seventh, and eighth ribs. “Digestion and circulation,” says Thackrah, “are so much impaired that the countenance would mark a shoemaker almost as well as a tailor.” Tailors, according to the same authority, are very liable to fistula. The Registrar-General’s table exhibits considerable mortality among tailors at the younger ages, 25 to 45. Working watchmakers exhibit a peculiar deformity of the chest, which is deserving of notice. It consists of a permanent elevation of the right side of the thorax and right shoulder, and arises from the manner in which they bend over towards the left. Engravers are the victims of constrained posture, and suffer, in consequence, from affection of the head and digestive organs.

Milliners suffer from a variety of depressing influences, such as constrained posture, impure air, deficient exercise, tight lacing, &c.

All those occupations in which there is peculiar posture, coupled with deficient exercise, act as excitants of consumption; for, when the blood flows languidly along its channels, and almost stagnates in the viscera, the disposition of morbid product, as tubercle, is, of course, materially favoured.

7. *Occupations carried on in a close, heated atmosphere, or in alternations of heat and cold*, as those of bakers, sugar bakers, cooks, glass workers, iron-founders, smelters, blacksmiths, &c.

Bakers and sugar refiners work in a very high temperature, and, from the author's experience, not unfrequently suffer from diseases of the liver, especially cirrhosis, in the production of which the great heat has a share, as frequently, also, have their intemperate habits; it becomes important, therefore, to determine, in an individual following either of these occupations, the liability, or otherwise, to dyspepsia and bilious attacks. In both occupations severe colds, bronchitis, rheumatism, and consumption, are induced by great alternations of temperature—the inhalation of fine flour dust producing distinctive effects in bakers. Cooks and confectioners are also exposed to great heat, and suffer from affections of the digestive organs and head.

Blacksmiths are exposed to alternations of heat and cold, which render them liable to catarrhs, pleurisy, and rheumatism. M. le Docteur Masson, quoted by Dr. Lewis, says that they are subject to inflammation of the liver, which he attributes “to the repeated concussions which the liver receives from the action of the hammer upon the anvil; to the different compressions that this organ undergoes during the work; and, still more, to the excessive quantity of beer consumed, which disturbs the functions of the stomach, and influences, in a special manner, the biliary organ.”

8. *Occupations injurious from the habits with which they are very frequently associated*, as those of butchers, commercial travellers, wine merchants, licensed victuallers, brewers, distillers, coach drivers, cabmen, draymen, &c. Inquiry into habits in individuals pursuing any one of the above occupations becomes of paramount importance; and when any doubt exists upon the point, the life should be summarily declined. The evils and peculiar risks attending intemperance have already been sufficiently dwelt upon.

Licensed victuallers occupy so bad a position in the mortality tables that they should scarcely, under any circumstances, be accepted without a considerable addition to the premium. As a

matter of experience, the author would advise the rejection of a life of this class, unless, in every other respect, it be of first-rate character.

To what is to be attributed the position occupied by butchers in the summary of the Registrar-General? "This useful body of men," he observes, "experienced a much higher rate of mortality than any other class, except the licensed victuallers, at the ages under 65. Thus, at the age 35 to 45 the rate of mortality per 1,000 among farmers was 9; carpenters and joiners, 10; shoemakers, 11; blacksmiths, 12; tailors, 14; bakers, 15; butchers, 17. At the next decimal age, 45 to 55, the mortality of butchers was 23; at 55 to 65 it was 41, or higher than that of any other class." Does such mortality, he inquires, depend "on his diet, into which too much animal food and too little fruits and vegetables enter? on his drinking to excess? on his exposure to heat and cold? or, which is probably the most powerful cause, on the elements of decaying matter by which he is surrounded in his slaughter-house and its vicinity." The author's own experience goes to show that the last cause, to some extent, accounts for the high mortality of butchers, he having known houses to which the slaughter-house was adjacent, in which scarcely a year elapsed without a case of fever having developed itself. Habits of intemperance and gormandising, coupled with insufficient exercise, induce unhealthy plethora and abdominal diseases, and account for much of the mortality. Dr. Letheby's conclusion, as to the tolerable healthiness of the butchers of the city of London, may be explained by the fact that good animal diet counterbalances various depressing metropolitan influences. Perhaps, also, the extramural market and slaughter-houses are beginning to operate beneficially.

(*To be continued.*)

An Account of the Plan, Objects, and Progress of the International Association for obtaining a Uniform Decimal System of Measures, Weights, and Coins. By SAMUEL BROWN, F.R.G.S., F.S.S.

(Concluded from p. 162.)

THE recommendations were—"That a work should be published, in which should be given the history, and an analytical and comparative table, of the different systems of weights, measures, and coins of the different nations of the earth, to be translated and

published, under the supervision of the branch societies, in all the languages of the nations represented in the Association. 2. That, to ensure the accuracy of such a work, the branch societies should furnish information as to the monies, weights, and measures prevalent in each country, with their values in terms of the Metrical System. 3. That each branch society should use every means, especially by aid of the press, to enlighten public opinion on the subject, and to prepare for the meeting of an official International Congress for discussion thereon. 4. That, in the meantime, the branch societies should make every effort to procure that, in all statistical tables and documents, public and private, the different quantities and values should be accompanied by their reduction into the monies, weights, and measures of the Metrical System, so that all nations may have a common medium of comparison. And 5. That unity in the fineness of the coin, unity in the standard of value, and unity in weights and measures of all kinds, should be pursued, in order to facilitate the adoption of a uniform system."

These are the prominent objects of the branch society established in this country; and, strange as it may seem in a country where every element would seem in favour of their being successfully achieved—where the discussions on education have been so frequent and public—where commerce, both internal and external, has been developed with a rapidity almost marvellous—where the need of simplicity and easy translation into foreign systems is the most felt—and where the study of statistics has been pursued by private individuals and societies with the greatest ardour and labour—strange as it may seem, it is, nevertheless, true, that in this country the greatest difficulties have to be overcome, and the greatest obstacles are opposed to the change. Two reasons for this are easily perceptible. The first is, that, from the publicity of discussion in this country, no sooner is a new subject started than a multitude of speculators rise up with their several schemes and opinions; each one supports his own theory with a vigour and eagerness which prevents him from admitting the good there may be in other propositions, and thus a distracting variety of projects comes before the public; and, though the best may be recognised at last, it is long before it can make itself heard against the host of competitors. The second is, that from the power of local habits, and the aversion of the public generally to a system of centralization—and, perhaps, still more from a want of unity and harmony in legislative measures when any change has been attempted—the variety of local interests and of feelings of partiality to overcome in different

districts of the country, is too great to allow of ready facility in the introduction of a uniform and simple system, however great its advantages may appear.

The British branch of the Association has silently, but steadily, made progress. It has lost no opportunity of bringing the subject before the public, either by discussions at public meetings, or by pamphlets and papers which particular occasions called forth. At the first meeting, held on the 28th November, 1855, resolutions were passed pointing out the advantages to be derived from a uniform decimal system of measures, weights, and coins, to the commerce, social improvement of the people, science, legislation, postal and other relations with foreign countries, and the peace and free intercourse it was likely to promote throughout the world; and pledging the members of the Association, by free discussions and by diffusing information, to prepare the way for an International Congress. An address was presented to the King of Sardinia on his visit to this country, and His Majesty's reply, forwarded through the Sardinian ambassador, gave flattering testimony to the advantages which Sardinia has already derived from the introduction into that country of the Metrical System in its entirety. When the delegates of the German States were assembled at Vienna to reform the monetary system, addresses were presented to them, both from the central Association and the British branch, urging upon their attention the great objects which the members were desirous of promoting, and requesting permission to co-operate in making the monetary system to be adopted one that might embrace the requirements, not merely of Germany, but of Western Europe. The reply from Baron de Bruck, the Austrian Minister of Finance, though not recognising the power of the Congress to transact business with foreign associations, was yet encouraging, as it stated that the Austrian Government had introduced the half-kilogramme (which, in Austria and the German Zollverein, had already the value of one Zoll-pound) divided into millièmes; and, further, that they were inclined to introduce, in gold and silver money, nine tenths of fine and one tenth of copper, by which they approached in two essential points the aims of the International Association.

At the first meeting of the British branch, it was resolved to collect information as to the variety of weights and measures in use in different parts of Great Britain. For this end, a circular was sent to municipal bodies, mechanics' institutions, chambers of commerce, and agricultural associations throughout the country. The

returns, classified in a table published by the Society, exhibit a very remarkable view of the discrepancies which are found in different localities of weights and measures under the same name. The linear measures of land, for instance, differ from 3 feet, used at Hertford, to the chain of 66 feet, used at Hastings, and include between these limits seventeen different measures in different places. In superficial measures of land, twenty-five varieties exist; and the acre itself varies from 4,840 square yards to 10,240 square yards. Wheat, oats, and barley appear to be sold indiscriminately, by weight or measure, the bushel undergoing all sorts of changes in quantity, and giving place in some districts to the load of 3 or 5 or 40 bushels, of 5 quarters, 144 quarters, or 488 lbs.—to the bag, the stack, the boll, the comb, the windle, the hobbet, the strike, the stone, the barrel, the winch, all differing from each other. For the sale of butter there is the pound, which has in different places 16, 18, 20, 24 ounces, besides the pint, the dish, and the roll. Potatoes, pork, flour, and coals are variously sold by weights or measures having no relation to each other. The measure of timber and brickwork would be equally unintelligible to inhabitants of different localities; and in wool and flax the stone differs from 16 to $24\frac{1}{2}$ lbs. These preliminary inquiries alone would be sufficient to prove the necessity for a change, and these differences are found in the returns from only forty places. What, then, may we expect when the answers come in from other parts of the kingdom? In the first general meeting of the British branch a petition was consequently agreed to, and presented to Parliament, showing the necessity of remedying the evils arising from the differences that prevailed in the weights and measures of the United Kingdom, and urging that the Honourable House would present an address to Her Majesty, praying for the issue of a Royal Commission to examine into the whole question, with a view to obtain a simplification of the system in this country, and its uniformity with the weights and measures of the principal countries in the world.

In June, 1856, the delegates of the institutions in union with the Society of Arts assembled as usual in London; and, by the kindness of the Council of that Society, the opportunity was afforded of bringing before them the very important question now under discussion. A very interesting debate ensued. Many of the delegates had not merely remarked the incongruities of the existing system, but experienced the practical inconvenience of it in the internal trade of the country. The information they brought to

bear on the subject, from various parts of the country, was of the most valuable kind; and the resolutions, unanimously passed, tended to diffuse throughout the provinces information on the aims and objects of the Association, and to lead to a full discussion of the subject amongst the provincial institutions in union with the Society of Arts.

In the autumn of the same year, the Free Trade Congress was held at Brussels, at which an address, agreed to at a special meeting called for the purpose, pressed upon the members of that important Congress the decimal and uniform system of measures, weights, and coins, as one of the most efficient means of encouraging free trade, and extending the commercial relations of all the nations of the world. The deputation from Great Britain consisted of James Yates, Esq., F.R.S., one of the vice-presidents; Wm. Ewart, Esq., M.P.; Edwin Chadwick, C.B.; George Buchanan, M.D.; and George Lawford, Esq.; and there were also present, from the Paris committee, MM. Wolowsky, Garnier, and Belly. The result was, that measures were adopted for the formation of a Belgian Committee; and in an interview which Mr. Yates, before his departure, had with the Belgian Minister for Foreign Affairs and the Minister for Finance, those high functionaries expressed their interest in the aims of the Association, and promised it their support.

Since that time, the most important step of the British branch Association has been the discussion; which has been continued at four successive meetings of the members, on the best international unit of length. The various projects and recommendations which have either appeared in published works, or in letters to members of the council, or been supported by public bodies or learned societies, were brought under review; and, after allowing full weight to the objections of various opponents who were invited to be present at the discussion, it was decided, that the metre has every quality that can be desired in a unit, which is to be employed as the basis of an international and decimal system.

A full and very able report of all the arguments in favour of, or of objections made against, the metre, as a unit of length, has been prepared by Mr. Yates, and published by the Association; and those who take an interest in the subject will find therein, not merely the history of the Metrical System, but an account of its extension into the various countries of Europe, and the means by which the obstacles to its progress have been overcome. It is proposed, in the course of the ensuing session, to proceed with

the discussion of weights and measures of capacity derived from the metre, and to continue the collection of information on the existing system, with all its anomalies and incongruities, in this country.

Besides the public discussions and steps taken by the Association to interest Governments, or learned societies, or commercial institutions, in the subject, various pamphlets have been written by the members and freely circulated amongst the public. *The Narrative of the Origin and Formation of the Association*, by James Yates, M.A., and his *Report on the best Unit of Length; Decimal Coinage, should it be International?* by T. C. Mossom Meekins, Esq.; *The Decimal System of Measures, Weights, and Money*, by Wm. Arthur Jones, M.A.; and *On a Uniform System of Weights, Measures, and Coins for all Nations*, by Henry Hennessy, F.R.S., may be referred to, amongst other papers, as showing the efforts which the members have made to keep alive the interest of the subject in the minds of the public at large.

Whatever be the obstacles to a revision of existing systems, whatever the aversion to unnecessary changes, there can be no doubt that the inconveniences and absurdities of the present are becoming sensibly felt. Everything is in favour of progress towards a simple and universal decimal system of measures, weights, and coins, interchangeable, at least, if not identical, in its units. The interests of commerce, of education, of national intercourse, of universal peace, earnestly demand it; and the members of this Association labour assiduously, and give their time and exertions to carry out its objects, sustained and animated by the conviction that they have no selfish ends in view, but are struggling for the advance of civilisation, and the permanent happiness of mankind.

The First American Life Underwriters' Convention.

[The following Report, or Statement, is, we think, of quite sufficient interest to justify our reprinting it at the length we now do; copies of it have, we believe, been forwarded to several members of the Institute; but it seems desirable that a movement of so much importance to the business of life assurance in the United States, and consequently to the profession here, should be permanently recorded in this *Journal*. We are rather apt to pride ourselves in this country on the practical character of our proceedings, when such a matter as this is taken in hand. It will be seen, however, that our American friends are by no means behind us on this occasion. It would hardly have been possible to address themselves with more directness

of purpose than they have done to the solution of the questions proposed, or to have selected those questions with more judgment. It is possible, and, indeed, just perceptible, that the exigencies of the theory of the subject are not, as yet, generally sufficiently understood and appreciated; but, since some of the members, we believe, are highly qualified in this respect, this want, if it exist, will soon be supplied, and we may thus congratulate the profession here on the sudden rising up of such valuable fellow-labourers, and on the prospect of their making a large addition to the common stock of this branch of knowledge. It would, indeed, have been surprising, if such shrewd and acute observers as Americans have shown themselves to be, had allowed the welfare, and almost the very existence, of their now flourishing life assurance institutions, to rest on a foundation, constructed, as one of the committees' reports very appropriately phrases it, by *guess-work*.—Ed. A. M.]

The First American Life Underwriters' Convention, held at the Astor House, Broadway, New York, on Wednesday and Thursday, May 25th and 26th, 1859.—A convention of persons engaged in the business of life assurance assembled at the Astor House, in the city of New York, on Wednesday, the 25th day of May, 1859, at 10 o'clock, A.M., pursuant to the following public announcement:—

“The First American Life Underwriters' Convention will be held at the Astor House, Broadway, New York, on Wednesday and Thursday, the 25th and 26th instant.

“(Signed) G. E. CURRIE, *Secretary pro tem*.

“May 20th, 1859.”

The following were present:—Morris Franklin, President of the New York Life Insurance Company, N. Y.; Sheppard Homans, Actuary, Mutual Life Insurance Company of New York; Isaac Abbatt, Secretary, Mutual Life Insurance Company of New York; R. G. H. Huntington, Agent, Mutual Life Insurance Company of New York; J. W. Horner, Secretary, Penn Mutual Life Insurance Company of Philadelphia; Lewis Merrill, Actuary, Penn Mutual Life Insurance Company of Philadelphia; E. A. Bulkeley, President, Aetna Life Insurance Company, Hartford, Ct.; J. W. Judd, Agent, Union Mutual Life Insurance Company, Maine; Thomas W. Russell, Vice-President, Charter Oak Life Insurance Company, Hartford, Ct.; Samuel H. White, Secretary, Charter Oak Life Insurance Company, Hartford, Ct.; Benjamin Noyes, Secretary, American Mutual Life Insurance Company, New Haven, Ct.; A. B. McDonald, Agent, Royal Insurance Company of Liverpool, England; John V. Yatman, Actuary, Royal Insurance Company of Liverpool, England; William H. Hill, Secretary, American Temperance Life Insurance Company, Hartford, Ct.; Benjamin Chickering, Secretary, Berkshire Life Insurance Company, Massachusetts; R. S. Buchanan, Agent, Eagle and Albion Life Insurance Company of London; John Eadie, Secretary, United States Life Insurance Company of New York; Henry B. Hyde, Vice-President, Equitable Life Assurance Society (organizing) of New York; Guy R. Phelps, Secretary, Connecticut Mutual Life Insurance Company of Hartford, Ct.; E. B. Watkinson, Director, Connecticut Mutual Life Insurance Company of Hartford, Ct.; W. S. Dunham, Agent, Connecticut Mutual Life Insurance Company of Hartford, Ct.; James Carpenter, Agent, Massachusetts Mutual Life Insurance Company, Springfield, Mass.; Gilbert E. Currie, of the *United States Insurance Gazette*; James McIver, of the *Insurance Monitor*; D. C. Whitman, of the Standard (organizing), Newark.

Mr. Gilbert E. Currie, having called the Convention to order, nominated the Hon. Morris Franklin as Chairman, who was unanimously elected.

Mr. Franklin addressed the Convention, relative to the mode of organizing, and suggested a Convention on Organization.

On the motion of John Eadie, the Chair appointed a committee of six on Permanent Organization, viz.:—John Eadie, Sheppard Homans, J. W. Horner, E. A. Bulkeley, Samuel H. White, and Benjamin Noyes.

The Convention took a recess, and the Committee on Permanent Organization retired.

On re-assembling, the Committee on Organization presented the following—

Report of Committee on Organization.—The Committee on Permanent Organization would respectfully report:—

“There being present several gentlemen not occupying official positions in any Company yet organized, the committee recommend that Gilbert E. Currie, Editor of the *United States Insurance Gazette and Magazine*; William S. Dunham, Agent of the Connecticut Mutual Life Insurance Company; D. C. Whitman, of the Standard Life Insurance Company of Newark, now organizing; Henry B. Hyde, Vice-President of the Equitable Life Assurance Society of New York, now organizing; R. G. H. Huntington, Agent of the Mutual Life Insurance Company of New York; E. B. Watkinson, Director of the Connecticut Mutual Life Insurance Company of Hartford; and James McIver, Associate Editor of the *Insurance Monitor*, be appointed honorary members of the Convention.

“For officers:—Frederick S. Winston, President; Morris Franklin, Vice-President; John Eadie, Secretary; and Sheppard Homans, Treasurer.

“That all votes in the Convention be by Companies.

“That committees be appointed to report:—

“1. On extra rates.

“2. On the mortality in the various geographical divisions of this continent, and on the collection of vital statistics.

“3. On the renewal of lapsed policies.

“4. On State legislation.

“That the following be recognised as the representatives of their respective Companies, viz.:—J. W. Judd, of the Union Mutual; R. S. Buchanan, of the Eagle and Albion; and A. B. Macdonald, of the Royal.

“All of which is respectfully submitted,

“JOHN EADIE.

E. A. BULKELEY.

“SHEPPARD HOMANS.

SAMUEL H. WHITE.

“J. W. HORNER.

BENJAMIN NOYES.”

On motion, the report was accepted, and the officers declared elected—viz., Frederick S. Winston, President; Morris Franklin, Vice-President; John Eadie, Secretary; and Sheppard Homans, Treasurer.

Mr. Bulkeley moved that the Chairman appoint the proposed committees.

Mr. Homans moved to amend, by referring to the President, Vice-President, and one other member, to be chosen by the Chairman, the appointment of the committees.

The vote being a tie on the amendment, and also on the original motion as amended, was decided affirmatively in each case by the casting vote of the Chairman.

Mr. Bulkeley was appointed to act with the President and Vice-President in the appointment of the committees.

Mr. Chickering addressed the Convention in regard to the question of lapsed policies.

Messrs. Homans and Russell referred to the mode of proceeding contemplated by the vote just taken.

On motion of Mr. Noyes, the Convention took a recess until 2 o'clock.

Afternoon Session, May 25th, 1859.

The Convention was called to order at a quarter past 2 o'clock, by the Vice-President, who introduced Frederick S. Winston, Esq., President-elect, to the Convention.

The President, on taking the chair, thanked the Convention for the honour conferred upon him. His absence in the morning was caused by an important business engagement entered into before the proposal for this Convention had been announced, and from which he found it impossible to be released. He regretted the occurrence, and hoped that the cause of his absence, which arose from no want of respect towards the Convention, would be a satisfactory apology.

The Convention expressed assent by general applause.

He had intended to offer some suggestions to the meeting, but would defer them for the present.

The minutes of the morning session were read.

The Vice-President introduced Mr. Erastus Lyman, President of the Knickerbocker Life Insurance Company of New York, and the President declared that Company represented in the Convention.

On motion of the Vice-President, Mr. Thomas Jones, Jun., Editor of the *Insurance Monitor* of New York, was elected an honorary member.

On motion of the Secretary, Mr. William Hadden, of *Tuckett's Insurance Journal*, Philadelphia, was elected an honorary member.

Mr. N. D. Morgan, President of the Manhattan Life Insurance Company, of New York, having taken his seat in the Convention, on motion of the Secretary, that Company was declared duly represented. Mr. Morgan stated the cause of his detention from the morning.

The Standing Committees.—Hon. Morris Franklin, from the Special Committee, presented the following report:—

"The committee to which was referred the nomination of delegates to constitute the various committees to take into consideration subjects to be presented for the consideration of the Convention, respectfully report that they have had the matter under advisement, and have agreed to recommend the following gentlemen as members of the several committees:—

"Upon Vital Statistics:—S. Homans, of the Mutual Life, New York; John Eadie, of the United States, New York; and Lieut. Lewis Merrill, of the Penn Mutual of Philadelphia.

"Upon Extra Rates:—Isaac Abbatt, of the Mutual Life, New York; Guy R. Phelps, of the Connecticut Mutual, Hartford; and R. S. Buchanan, of the Albion and Eagle, New York.

"Upon Renewal of Lapsed Policies:—Morris Franklin, of the New York Life, New York; Benj. Chickering, of the Berkshire Life, Mass.; and N. D. Morgan, of the Manhattan, New York.

"Upon State Legislation:—E. A. Bulkeley, of the Aetna, Hartford;

Benj. Noyes, of the American Mutual, New Haven; and A. B. McDonald, of the Royal, of Liverpool."

On motion, the report was accepted, and, each committee having been passed upon and approved by the Convention, the report was adopted.

The following were, on motion, elected honorary members of the Convention:—David Palmer, Knickerbocker Life Insurance Company, New York; James Stewart, United States Life Insurance Company, New York; P. D. Whitmore, Amicable Mutual Life Insurance Company, New Haven; James Donaghee, Amicable Mutual Life Insurance Company, New Haven; Professor Hedrick.

The question of adjournment being suggested by Mr. Bulkeley,

The President made a brief address in relation to the objects and aims of the Convention: these were only in the nature of inquiry, and not intended to bind any institution. He hoped that it was generally understood that, when this Convention finally adjourned, gentlemen would be as free, each to conduct the business of life assurance according to his own views, as before it assembled. The object was to ascertain if there were not subjects of interest, common alike to all, in which we might work together for the common good.

The Vice-President addressed the Convention on the same subject. It was, he hoped, understood, that this was not an assemblage in the nature of a caucus, or a dictatorial body, but a meeting of friends interested in the business of life insurance, to exchange views and experience. They met as brothers, and as brothers they would part, with an earnest desire to use their best endeavours to extend the principles and advantages of life insurance.

Mr. Bulkeley explained, on behalf of the Committee on Organization, that the views of the President, which had been so ably sustained by the Vice-President, coincided with those entertained by that committee. It was hoped and expected that, while the action of the Convention would be no more than advisory, it would be such as would prove acceptable to the great interests represented, and satisfactory to the whole community. General subjects only had been introduced, and beyond these the committee had not deemed it advisable to interfere. These were matters of common interest.

Mr. Thomas F. Plunkett, Vice-President of the Berkshire Mutual Life Insurance Company, Massachusetts, was introduced to the Convention and elected a member.

Messrs. Franklin, Phelps, Plunkett, Horner, and Jones were appointed a committee to make arrangements for a dinner at this place (the Astor House) to-morrow evening, at 7 o'clock.

On motion of the Vice-President, the President was added to the committee.

Adjourned to meet at 11 o'clock, A.M., to-morrow.

Thursday's (Second Day's) Session, May 26th, 1859.

The Convention assembled at 11 o'clock. Half-an-hour having been devoted to conversation, business was resumed; Frederick S. Winston, Esq., President, in the chair.

The minutes of yesterday afternoon's proceedings were read and approved.

Reports of committees, being the first business in order, were called for.

Mr. Homans, from the Committee on Vital Statistics, presented the following report:—

Report of Committee on Vital Statistics.—The committee on the mortality in various geographical divisions of this continent, and the collection of vital statistics, have had under careful consideration the important subjects confided to their care, and beg leave to submit the following report:—

“In view of the immense area of this country, embracing such diversities of soil and climate, over which the good influences of life insurance are extending, the committee are of opinion that, for convenience of reference, it would be advisable to divide the territory of the United States and Canada into different classes, as follows:—

“Class I.—The New England and Middle States.

“Class II.—The Western States.

“Class III.—The Southern States bordering on the Atlantic Ocean.

“Class IV.—The Southern States bordering on the Gulf of Mexico.

“Class V.—California, Oregon, Washington, and Utah territories.

“Class VI.—Within ten miles of the Mississippi Valley, below the 32nd parallel of latitude.

“Class VII.—Military and naval men, seamen, &c.

“Class VIII.—The Canada and British Possessions of North America.

“In regard to the second point, collection of vital statistics, to which the attention of the Committee has been directed, they wish to state that the limited time allotted to them will scarcely allow any other than a mere cursory glance at this most important subject.

“It is by no means a matter of gratulation to find that every American Life Company, without exception, has adopted rates of premium and rules of valuation based upon observations made three thousand miles away; that with upwards of *one hundred and fifty* millions of dollars at risk on the lives of more than fifty thousand American citizens, no united effort should have been made by American Life Companies for deducing the prevailing rate of mortality. If the English tables now in use, and adopted by us, afforded a fair representation of the mortality prevailing among assured lives in this country, then, however mortifying would be the conviction that we are benefiting by the skill and labour of our friends across the Atlantic, without making any compensation by way of return, the evil would be lessened; but such is not the case. The tables of mortality now used in this country are all defective, being the results of observations made upon miscellaneous communities of men, women, and children, and of all ages, can never represent satisfactorily the rate of mortality prevailing among assured lives, who are, in many respects, a *peculiar class*. The influences which surround the American are different from those which surround the European, and the comparative vital force, or ability to resist disease and death, varies on the two continents and at different ages. The committee, however, do not think it necessary to advance arguments to the gentlemen of this Convention, conversant as they are with this important subject, in order to prove the defects of existing life tables, or the necessity of improving them by constructing better. The evil is a practical one, and fortunately the remedy is at hand, *and under our own control*. We have gentlemen in this Convention, the representatives of Companies located in different parts of the country. The combined experience of these Companies would furnish data for framing a most reliable and valuable Life

Table, showing the rate of mortality among the class of assured lives in the United States. Such an experience, Mr. President, would be invaluable. No Company is so small as not to be able to contribute toward the formation of such a table, and no Company so large as not to derive great advantage from it. Such a table is essential to the proper understanding and solution of all questions involving the duration of human life. A knowledge of the laws of mortality is the very essence and foundation of the system of life insurance. Without it, the whole scheme would be but *guess-work*; with such a table, life insurance becomes a science—a noble science—second to none other in its beneficent influence upon mankind.

“In view of the great pecuniary interests involved, the committee are of opinion that it would be advisable for each Life Company in the United States to contribute certain data by which the combined experience of all American Companies can be deduced, having special reference to the comparative mortality in the different classes into which our country has been divided, the comparative mortality at different ages or epochs of life, and the comparative mortality under whole life and term policies.

“It was in this manner that the celebrated ‘Actuaries,’ or ‘Combined Experience’ Table of Mortality was obtained, which, in spite of many serious defects, is still the best representation of the value of assured lives in England extant.

“With additional experience and information, and by avoiding the errors which materially diminish the value of this celebrated table, the American Companies have now an opportunity of making a National Table of Mortality, which, while it will be of great practical value to each and every American Company, will also be an important contribution to science. We append blank forms of return.

“Respectfully submitted,

“SHEPPARD HOMANS,	} <i>Committee.”</i>
“JOHN EADIE,	
“LEWIS MERRILL,	

The President addressed the Convention upon the subject of vital statistics. He suggested a general expression of opinion upon this question, so intimately connected with the business of life insurance. An opportunity was now offered for consultation, such as had never before been presented, and he hoped every gentleman present would favour the Convention with his views.

The Secretary stated that the committee, in the brief period allowed for preparing the report, had probably overlooked some matters of importance, which had occurred to others. They did not claim to have laid down a perfect plan. They hoped that the Convention would take up the work, and perfect it.

Mr. Currie suggested hearty co-operation on the part of every Life Insurance Company throughout the country, and urged the individual exertion of every one engaged in the business, in furnishing and compiling the proposed returns. He had some acquaintance with the difficulties in the way of getting up this important information, and his past experience clearly showed that the chief obstacles lay with the officers of the Companies themselves. He, some four years ago, was engaged in securing statistics on fire risks—their classification, and the number of fires under each class. Forms were printed and circulated among the officers. But the plan, throughout the

Union, proved abortive, simply, and alone, in consequence of apathy and indifference on the part of officers themselves, in not attending to their duty. He hoped that this would not prove to be the case with the present movement. The evil complained of here could only be averted by every life insurance officer doing his duty. The plan drawn up by the committee appeared to him to be worthy the support of the Convention. He deemed it in every respect well fitted to accomplish the object. He referred to the great importance of this department, in its bearing upon the permanent welfare of every Company.

Mr. Bulkeley approved of the object for which the committee had been appointed, and favoured the adoption of the report. No Company would refuse to contribute its experience to accomplish this desirable result, the formation of an American table of mortality. It was a great national work, in which every institution could feel the highest interest. The plan drawn up by the committee would accomplish all that was required.

The President remarked that there was another subject deserving attention, that of sanitary regulations, and he referred to it in this connexion, so that, if deemed advisable, it might be acted upon, or be the means of suggesting inquiries collateral to the question under consideration. He considered that sanitary precautions were of very great importance. . . .

The Secretary referred to the mortality in this city, as indicating a great want of sanitary regulations. New York exhibited a heavy mortality for a city so favourably situated. He believed the annual rate was one in twenty-four, and inquired of Mr. Homans whether that was the present rate.

Mr. Homans stated that the rate had been as low as one in twenty-three.

The Secretary alluded to the significance of this fact, and referred to the position of New York, as the commercial and financial metropolis, a position which she could not hope to maintain if improved sanitary regulations were neglected, for commerce and capital had fled in all ages from social negligence.

Lieut. Merrill spoke of the mortality from wounds received in action. It was much less than was generally supposed. An increase of one or two years, in the rate charged for insurance at a given age, as, for example, a person twenty-five years of age being charged the rates of one aged twenty-seven, would meet the increased risk of death from wounds in battle. He referred to statistics compiled by Dr. Coolidge, of Washington, and suggested that application to the War Department, for mortuary experience, would be cordially responded to. He also gave the results of calculations, showing that the actual mortality in nearly all wars, within ninety years, had been about one death to every ten thousand balls fired. In the late Crimean war, the rate of mortality from all sources corresponded almost exactly with that of our war with Mexico. He referred to the variations of mortality exhibited in the returns from the United States military posts, and suggested the importance to every Company of having copies of the returns which had been published by, and could be procured from, the War Department.

The President inquired whether modern improvements in gunnery would render war more destructive to life.

Lieut. Merrill thought not. The results would be about the same. What could be done with the old arms at a distance of four hundred yards could be done with the new ones at a distance of a thousand yards or a mile; and although much had been said on this subject, he had come to the conclusion that the deadly effect would be about the same as it had been. In

relation to those chemical compounds, noxious gases, or poisons, with which the name of the late Dr. Lardner and others had been connected, they would be considered dishonourable by civilised nations, and to resort to these modes of warfare would be as infamous as to poison the springs in an enemy's country or to resort to assassination. No enlightened nation would adopt them. . . .

The business before the Convention was laid aside, and the following gentlemen, on motion, were elected honorary members:—Mr. S. A. Howland, of Worcester, Mass.; Mr. John F. Entz (Consulting Actuary), with the New York Life Insurance and Trust Company; Mr. Robert Ayres, of the Knickerbocker Life Insurance Company; Mr. Joseph B. Ecclesine, Editor of the *Wall Street Underwriter*; and Mr. T. T. May, of the American Mutual Life Insurance Company.

Short Term Policies.—The consideration of the report on vital statistics being resumed,

Mr. Chickering moved that the committee be requested to ascertain the rate of mortality among assured lives under short term policies.

Mr. Yatman referred to the general question under consideration, and to the practicability of distinguishing, in the returns, between life and short term policies.

Mr. Morgan spoke upon the general question, and referred also to the question of "special risks," as distinguished from "extra rates." He also alluded to the practical results, ascertained by offices generally, from their individual experience.

Mr. Homans referred to short term policies, and to observations, resulting from experience, upon this class of business, as well as special risks.

Mr. Noyes alluded to the difficulties connected with special risks, and spoke also on the general question, as well as upon short term policies.

The President, Mr. Chickering, Mr. Morgan, and Mr. Noyes spoke upon the same subject.

The motion made by Mr. Chickering was then passed unanimously.

On motion, the report of the Committee on Vital Statistics was adopted.

Extra Rates.—Mr. Phelps stated that the Committee on Extra Rates had not prepared a report, and would await the action of the Convention. He spoke upon the question, and referred to practical results.

Mr. Ecclesine presented to the Convention printed sheets, showing the rates for insurance charged by twenty-seven Companies.

The President, Mr. Phelps, Mr. Morgan, and Mr. Noyes referred to the question of extra rates.

The Secretary, to ascertain the views of the Convention, moved that the Committee on Extra Rates be continued indefinitely.

Mr. Morgan suggested that a difficulty might arise in determining the rates.

The President remarked, that the Convention did not bind any office to the rates which might be ascertained by the committee. . . .

Mr. Yatman deemed it practicable to procure valuable information by means of such a committee. He also referred to mortuary statistics generally, and the influence of social position upon longevity. In the case of great cities, Liverpool, for example, the general average of life was reduced in the tables by excessive mortality among infants.

The Secretary withdrew the motion to continue the committee indefinitely.

Mr. Morgan moved to discharge the committee.

Mr. Chickering suggested that, in discharging the committee, as a Committee on Extra *Rates*, it would be desirable, in order to carry out the objects of the Convention, that they should be reappointed as a Committee on Extra and Special *Risks*.

Mr. Noyes concurred in the views expressed by Mr. Chickering.

The motion of Mr. Morgan, to discharge the committee, was then adopted.

On motion of Mr. Chickering, it was Resolved—"That Messrs. Phelps, Buchanan, and Horner be a committee to collect and collate, for the use of this Convention, the experience of American Life Insurance Companies in regard to extra and special risks, such as occupations and voyages, and the climatic influences connected therewith."

Report of Committee on Lapsed Policies.—Mr. Franklin, chairman of the committee, submitted the following report:—

"The committee to which was referred the subject of Renewals and Lapsed Policies, respectfully report that they have had the subject under consideration, and gave it such attention as the limited time would permit; but from the important interests involved, and the various customs in reference thereto, they have arrived at the conclusion that it is not expedient at this time for the Convention to express any decided opinion upon the subject. They would, however, recommend that an informal conversation be had among the members of this Convention, in order that the views of the various Companies may be known, but that it shall not be considered as a formal expression of the views of the Convention.

Respectfully submitted,

"MORRIS FRANKLIN,
"BENJ. CHICKERING,
"N. D. MORGAN."

New York, May 26th, 1859.

The report was accepted, and the committee discharged.

On motion, a Finance Committee was appointed, consisting of Messrs. Morgan and Currie, and the Secretary.

Report on Legislation.—Judge Bulkeley, chairman of the Committee on Legislation, presented the following report, which was read by Mr. Noyes:—

"To F. S. WINSTON, Esq., *President of the Life Insurance Underwriters' Convention, New York:*—

"The undersigned, to whom was referred by the Convention the subject of 'State Laws,' having discharged their duties, beg leave to report that the laws of the States which relate to Life Insurance Companies and their agencies, are found to be very dissimilar, and in many instances, not only conflicting, but retaliatory in their origin and character.

"The business of life insurance, like that of fire insurance, must extend over territory sufficient to secure healthy and self-supporting averages. Consequently, no Life Insurance Company has yet been organized with reference solely to the limited territory of its own State.

"The announcement of the organization of a new Life Insurance Company is but the signal of progress. No sooner is it announced, than the citizens of other States seek for appointments as agents, and are eager to present the claims of life insurance to their friends.

"Anticipating no encroachments by their own laws, upon their right to

transact business for a corporation located in another State, they proceed, but often find themselves implicated in penalties, for not satisfying the demands of laws which are personal in their application, and which found their way upon the statute-books they know not how, and which, in some cases, go so far as to attempt to visit penalties upon the Companies themselves.

"This state of things has been brought home to Life Insurance Companies to such an extent, that it has become necessary for each Institution to attempt to understand the laws of all the States to whose citizens they grant agencies and policies of insurance.

"The frequent modifications of these laws, and the severe enactments which are added, and the complications which grow out of the various forms for making returns adopted by the officers which these laws create, have so far confused the public mind, and embarrassed the business of life insurance, that relief should be afforded.

"The uniform law-abiding spirit, which is interwoven into the management of Life Insurance Companies, induces on their part a strenuous effort to comply with all laws and evade none; but they are met constantly by new laws and new requirements, which, by undertaking to comply with, literally establish for them results in different States which conflict with each other, and add again to the difficulty above alluded to.

"Your committee are not the advocates of no law; on the contrary, in their opinion, it is eminently wise and just, on the part of every State, to enact laws relating to Life Insurance Companies and their agencies; and they recognise the right of every State to hold the Companies which are organized under their own laws to a strict accountability.

"But any system of legislation which interferes with the legitimate business of life insurance, and dictates or attempts to nullify rules and regulations which Life Insurance Companies see fit to incorporate into their plans of operation, and which are in conformity with their charters, we regard as pernicious, and we believe that many such acts have been originated by persons who are neither managers of Life Insurance Companies nor holders of their policies.

"Your committee are of opinion, and they believe it to be the sense of this Convention, that the legislation of all the States, relating to Life Insurance Companies incorporated by other States, should be uniform and simple, and of such a character as to secure the public against Companies not organized according to law.

"That each Company should be required to exhibit its condition in a proper manner, so that the public may know the amount of its capital, accumulations, and surplus, and how the same are invested, and such other facts as are necessary to a proper understanding of the condition of the Company.

"They should also be required to state the amount of losses unpaid, and all other claims against them.

"This being done, the amount remaining, after deducting the losses and claims, indicates the amount of capital, or fund, upon which the Company rests, and by it, the public, aided by the information which honourable competition disseminates, would judge for themselves, and act accordingly.

"Your committee feel constrained to say, that new value would attach to new laws relating to life insurance, if the States would severally aid the cause of life insurance by laws which furnish vital statistics, and which, if regularly collected, would benefit, not only Life Insurance Companies, but the public at large.

"Your committee, in conclusion, would recommend that this Convention, before it adjourns, appoint a committee to draft a general law, applicable to a majority of the States, relating to Life Insurance Companies incorporated by other States, and the agencies of such Companies, in which foreign Life Insurance Companies shall be properly provided for, upon the same principles as are the Companies of other States, and also prepare a blank, adapted to the law for annual returns by such Companies, and present the same at the next meeting of this Convention.

"All of which is respectfully submitted.

"E. A. BULKELEY,

"BENJ. NOYES,

"A. B. McDONALD."

Judge Bulkeley addressed the Convention in explanation of the views of the committee. Conflicting legislation throughout the States had produced much embarrassment to all Companies. In one State, there had been different interpretations of the law by the State officers. In another State, a law had been passed which expelled every Company that had complied with the law of a neighbouring State. He proceeded to illustrate the practical evils resulting from the legislation of the different States, and the interminable amount of detail involved. "What is wanted," he remarked, "is a general law, applicable to each and every State, such as the common sense and intelligence of every legislator would sanction and approve."

On motion, the report was accepted.

Mr. Currie addressed the Convention in support of the suggestions of the committee. He concurred in the views expressed by Judge Bulkeley. Not only were the laws of the different States at variance with one another, but even the laws of each State, in relation to Insurance Companies, change year by year with each successive legislature. If the Convention were unable to effect any other benefit than the revision of the various laws on insurance, with a view to their equity, reciprocity, and harmony of operations, enough would be gained fully to compensate for all the toil, trouble, and expense to which the Life Underwriters had been put, by assembling in Convention at this time. But he believed something more than this would be effected by the present Convention; if the underwriters were only faithful to themselves and the interests they profess to have at heart, they would be able to make themselves respectfully heard in every legislative assembly in the Union.

The report was, on motion, adopted.

The following resolution, reported by the committee, was adopted:—Resolved, "That a committee be appointed to draft a general law, applicable to a majority of the States, relating to Life Insurance Companies incorporated by other States, and the agencies of such Companies; including, also, the agencies of foreign Life Insurance Companies."

On motion, it was decided that the committee should consist of six, including the president, viz., Messrs. Bulkeley, Horner, Plunkett, Noyes, and Jones, and the President.

Rate of Interest.—Mr. Morgan addressed the Convention on the subject of the rate of interest which is likely to prevail in this country in future. He deemed it an important subject for inquiry, and submitted the following resolution:—Resolved, "That a committee of three be appointed to take into consideration the subject of the rate of interest of money, and report at an early day to the president their views as to whether the

present average current rate of interest on permanent investments will be likely to be maintained or diminished."

The Secretary spoke in favour of the proposed inquiry, and referred to the general questions of the interest of money and the currency.

Lieut. Merrill alluded to the influence which the rate of interest exerted upon the rates of premium, and to the practical influences of rates of premium upon the business of Companies.

On the motion of Mr. Chickering, the following preamble and resolutions were adopted:—

"Whereas it is the opinion of this Convention (in accordance with the report already adopted), that it is very desirable that each of the Companies in the United States should unite in a contribution towards the determination of the general experience of the rate of mortality among assured lives in the United States:—"

"Resolved—That Messrs. Homans and Eadie, of New York, and Russell, of Hartford, be appointed a committee to carry into effect a report on vital statistics adopted by this Convention."

"Resolved—That in conferring with the different Life Companies, and soliciting statements from those not represented in this Convention, the committee assure them that such statements shall be regarded as strictly confidential."

"Resolved—That this committee be instructed to treat all statements furnished by the several Companies as strictly confidential, and to make public only the combined experience ascertained as the result of such statements. That as soon as the necessary blanks can be procured, the said committee furnish them to the different Companies, requesting as early replies, and up to as recent dates, as the committee shall see fit."

"Resolved—That the expense of collecting and publishing said statistics be paid by the Companies jointly, and each Company contributing their experience shall be entitled to one or more copies of the same."

On the motion of Mr. Morgan, it was resolved, "That when the Convention adjourn, it adjourn to meet again at the call of the President, on the requisition of any three Companies represented in the Convention."

On the motion of the Secretary, it was resolved, "That all expenses incurred by this Convention other than those for the proposed dinner, be defrayed by the Companies represented."

On motion, the President and Vice-President were authorized to co-operate with the Secretary in recording the proceedings of the Convention.

Judge Bulkeley having moved "That the Convention do now adjourn," the President addressed the delegates as follows:—

Closing Address of the President.—Gentlemen—Members of the Convention of Life Assurers:—Before we close the business of the Convention and separate to pursue our various avocations, I ask your attention to a few suggestions and facts connected with, and growing out of, this our first meeting. I congratulate you upon the fact that this meeting has been held; upon the zeal and intelligence which have marked its deliberations, its debates, and its reports; and for the courtesy, unity, and harmony which have characterised its proceedings to its close. We met because each felt the necessity of mutual information and united experience in a business comparatively new to all, and requiring an amount of knowledge and skill of which each felt that they were not individually possessed. Could we have transferred the theory and practice of life assurance, as it

has existed and been developed and perfected in Great Britain for over one hundred and sixty years, to this country, unchanged, with propriety and success, the responsibility and labour of the business would have been, and still would be, comparatively light. But, instead of an isolated country like Great Britain—of limited geographical extent, with a temperate and genial climate, and with kindred races of men engaged in similar pursuits and with common habits—we have to provide for the necessities of a country reaching from the Arctic regions to the Gulf of Mexico, and from the Atlantic to the Pacific Oceans—with every variety of climate, subject to every class of disease, and peopled by races from every quarter of the globe, and with physical constitutions, habits, and pursuits, as multiform and varied as the sources from which they spring. Life and its pursuits are intensified here; and even the European, when domesticated, no more retains his habits and pursuits than he does the political systems he left behind him. Hence the absolute necessity of an American experience in life assurance, not only to meet the wants of our own native population, but of the foreign citizens who may become located and domesticated among us. This practical question then arises, How shall we obtain such accurate and reliable statistics of American experience as are vitally necessary for the safe and intelligent conduct of life assurance in the United States? English or Continental experiences, accurate and excellent as they may be, do not meet our necessities. Life statistics, as gathered by our State or municipal authorities or by our General Government, are unreliable for our purposes, for the double reason that they are mostly taken and collated by careless or incompetent persons, and they refer to and represent the masses of the population; while the candidates and members of our Life Assurance Companies are taken out from the mass and are embraced in a few of the professions and occupations, and from the ages of 20 to 60 years. If, then, we are to have an American experience in life statistics, which, for scope, accuracy, and extent, shall be reliable as a basis for our business, it must be sought, developed, and arranged by our Life Assurance Companies. It will not, it cannot, emanate from any other source. Each and all interested in this business must labour earnestly for the attainment of this end. Look for a moment at the rapid growth and present magnitude of life assurance in this country. In 1825, the first Company chartered (the Massachusetts Hospital and Life Insurance Company) commenced its business. In 1829, the New York Life Insurance and Trust Company was chartered. Though of the highest standing, and possessing fully the public confidence, both of these institutions found the Trust business, authorized by their charter, to be more attractive than life assurance, and for several years neither of these Companies have made any effort to increase the number of its policies. Most of the remaining Companies in this country are of recent date, and very few of the number have seen the period of half a generation, yet the magnitude of this business is such that the following facts appear in the reports of but ten Companies doing business in this State, for the year 1857. They are taken from sworn reports made to the Comptroller of this State, on file in his department:

		Dollars.
Number of policies issued in 1857	7,000.	
Amount assured		20,478,857 00
Whole number of running policies	40,518.	
Whole amount at risk		110,124,014 00
Income of these Companies for the year		3,965,600 00
Paid claims by death		1,153,655 00
Total assets of these ten Companies		14,240,700 00

Had we the time to collect and present the statistics of the much greater number of Companies whose reports do not appear upon the records of our State Department, you would be astonished at the rapid growth and development of life assurance in this country. The united experience of these Companies, though short as to duration of time, would, if properly developed, be exceedingly valuable, especially when we take into consideration the fact, that the experience of one of them embraces a greater number of assured lives than were included in the population from which the English Carlisle and the Northampton Tables were formed—which tables, as you know, have been until recently those in use by all the Life Assurance Companies of Great Britain. But there are other practical and scientific subjects of vast importance which press upon our attention. Every Life Assurance Company should possess, in its executive management, competent statistical information, mathematical knowledge, geographical science—knowledge of man in his various races, physical constitutions, habits, and his longevity in each—of climates and their effects on the constitutions of the inhabitants—of the special epidemic and other diseases incident to various climates—of employment and occupation, active and sedentary, out-door or confined, and the effect of each on health and longevity, and of extra risks of climate, exposure, and occupation by sea and by land. Another most important branch of practical knowledge is that relating to the investment of funds. The soundest principles of assurance, as demonstrated by proper tables of rates for premium and the most careful selection of lives, may be rendered of no avail unless the funds raised are securely and profitably invested. These are among the important branches of knowledge vitally necessary to the safe and successful pursuit of the business of life assurance. None will put forth the claim that they individually possess this knowledge, nor can any one, unassisted, obtain it. Collectively, we have it, but it is undeveloped. Let us, therefore, unite in collecting, arranging, and perfecting such a system as, while it is useful to ourselves as assurers, will reflect credit upon the body from which it emanates. In importance to the State in protecting and sustaining those who might become a burden upon it—to society in elevating those who receive its bounty, and who might otherwise sink, through want, into crime—to families, who are by it kept together and trained and educated for usefulness—and to individuals, many of whom, without its benign aid, would sink from positions of comfort and luxury to wretchedness, and dependence or destitution, life assurance stands forth an element for good exceeded by none. No business pursuit exceeds it in dignity; and none, with which I have any knowledge, requires higher qualifications in integrity, intelligence, scientific attainment, conservatism, and sound practical judgment, than this. Of all business it is the most certain, if properly pursued, for its principles and calculations rest upon fixed Providential laws, which are the immutable laws of God.”

On the motion of Mr. Noyes, the proceedings of the Convention were directed to be published under the direction of the officers.

The thanks of the Convention were, on motion, tendered to Mr. Gilbert E. Currie, to the President, and to the Secretary.

On the motion of Mr. Phelps, it was resolved, “That a committee of three be appointed to report to this Convention such sanitary regulations and statistics as may be considered important to the subject of life insurance.”

Messrs. Phelps, Horner, and Carpenter were appointed the Sanitary

Committee; and, on motion of Mr. Morgan, the committee were empowered, in their discretion, to add to their number four physicians, or others, not members of this Convention.

On the motion of the Secretary, the thanks of the Convention were tendered to the gentlemen of the Press who had attended to report the proceedings.

The Convention then adjourned.

JOHN EADIE, *Secretary.*

The Convention of Life Assurance Underwriters closed its proceedings at their first annual session by a dinner at the Astor House, on Thursday evening, May 26th. About one hundred delegates and invited guests were present, among whom were Mayor Tiemann, Dr. D. M. Reese, Messrs. Morris Franklin, Fred. S. Winston, John Eadie, N. D. Morgan, E. A. Stansbury, G. E. Currie, J. Green Pearson, J. Smith Homans, and other well-known citizens.

At seven o'clock, the chair was taken by the Hon. Morris Franklin, the President of the United States Life Insurance Company, and the company then proceeded to enjoy the excellent and liberal entertainment provided for them by their hosts of the "Astor."

In the course of the evening, the following regular and volunteer toasts were proposed, and responded to by parties interested in the subjects to which they relate:—

"The City of New York, the emporium of commerce and the financial centre of the commercial world."

"Life Assurance—the offspring of a union of profound philanthropy with scientific research; extending into all lands; lending a helping hand to the widow and the orphan; and, wherever practised, a firm index of high moral feeling and commercial confidence."

"Mathematical and statistical science—to the principles of life insurance what the compass is to the mariner."

"The Medical Profession—its age has made it venerable, and the humanity of its members rendered it illustrious."

"Fire Insurance Companies—the firm basis of business credit; the staple defence of private prosperity; their success is identified with that of the whole community."

"The Marine Insurance Companies.—We hail them as co-workers with us in the preservation, accumulation, and distribution of individual wealth."

"New England—the home of education, thrift, and intelligence."

"The Press—the palladium of our institutions and the echo of the voice of the people."

"The Ladies.—By embracing the principles of life insurance we show forth our gratitude for this best gift of Heaven to man."

"Our Medical Examiners—educated, intelligent, and prudent. To their skill, care, and integrity in the selection of lives, are we indebted, in a very great degree, for our success in life insurance. May their services be appreciated and better paid."

"The responsible Foreign Companies.—We hail them as worthy co-labourers in a noble cause."

"Mr. Sheppard Homans—the accomplished actuary of the Mutual Life. May he slide gently down his adjusted life-curve, and at the end find that, for once, he was mistaken, and 104 is not the limit of *his* life table."

“Life Insurance.—Its great mission is to prepare the dying for death, and to administer consolation to the bereaved.”

“The principles of life insurance, like free government, susceptible of indefinite expansion.”

“The soliciting agents of all Life Insurance Companies.”

FOREIGN INTELLIGENCE.

On Insurance in France against Hail, Frost, Inundations, and Mortality of Cattle. (Translated and abridged, by S. B., from a Pamphlet by M. le Hir, Avocat à la Cour Impériale, Juge de Paix Suppléant du XI^e Arrondissement, Foreign Correspondent of the Institute of Actuaries.)

In preceding numbers of this *Journal* we have given various statements showing the very great progress which has been made in the business of fire insurance in France; and in vol. iii., p. 56, will be found a notice of hail insurance by Mutual Companies in France; but M. le Hir, of Paris, who is one of the corresponding members of the Institute, has paid so much attention to the subject of all the four classes of insurance above referred to, and collected the statistics so accurately, with the view of carrying out a great scheme of mutual insurance only partially dependent on the Government, that we propose to avail ourselves of his labours to give some new and striking information which he has collected to a recent period. The original documents, showing the losses experienced in different communes, are preserved in the Ministry of Agriculture and Commerce in Paris, forwarded by the Prefects of Departments as a guide to the Government in the distribution of the succour to be afforded to the agricultural interest suffering from these calamities. M. le Hir possesses no less than 12,000 statements, comprising the years 1826 to 1858, classified according to departments, arrondissements, cantons, and communes, and showing, in each of the 32 years, how frequently each commune of France has been afflicted with these scourges, and the total amount of losses experienced.

The necessity of these classes of insurance is demonstrated by the frightful disasters to which the agricultural interest has been exposed. The mean annual losses by hail, frost, inundations, or mortality of cattle, are estimated at 100 millions of francs (£4,000,000 sterling). The ravages of hail alone amounted, in 1839, to 117 millions of francs (£4,680,000), and in 1840, 1846, and 1856, the towns and lands bordering upon the great rivers of France suffered terribly from inundations.

The more considerable, the more sudden, the more unequal is the damage caused by such calamities, the more useful and effectual appears the principle of assurance; for it is nothing more than the distribution over a number of years and a multitude of persons, of those heavy losses which may otherwise fall on a single individual or in a single year.

At the present time none of these classes of insurance are very prevalent in France—some not at all; were it otherwise, ruin would often be averted, and the losses less sensibly felt. Mutual assurance, there can be no doubt, might be established, upon a broad and stable basis, by the aid of private institutions; but failing this, the Government ought, unquestion-

ably, to meet so great a want. Some ardent economists, however, hasty in innovations, possessing more imagination than experience, have lately urged upon the Government the dangerous attempt to undertake all classes of insurance, including fire insurance; to render insurance obligatory, and to convert a premium into a tax. Such a principle requires some consideration.

There is no country in the world in which fire insurance has extended more rapidly or widely than in France, or in which it has attained a greater degree of perfection, especially since the development of mutual insurance and the happy influence which it exercises.

The Proprietary and Mutual Fire Insurance Companies together insured against fire property to the amount of 43 milliards of francs (£1,720,000,000) at the close of 1855. The average cost thereof, including all kinds of risks (theatres, manufactories, houses of wood, thatched houses, furniture, combustible or inflammable stores) was 84 cents per 1,000 francs of assured value (1s. 8d. per £100), or 97 cents in Proprietary Companies, and 50 cents in Mutual Companies. In England, the premium is computed to be equal to 2 francs per 1,000 francs insured (4s. per £100).

Seeing the great extent to which fire insurance has been carried, and the extremely low premiums which suffice for the risks, the Government may safely abstain from interference with this class of insurance, and yet favour the establishment of great mutual associations for the other risks already referred to. But a great question arises, whether, under any circumstances, these insurances should be made obligatory. At the present time such a process would probably be very unpopular, and it would seem more advisable to attract the public by favourable conditions and good guarantees, and when its benefits are more generally understood, the question of making it obligatory may be more easily discussed. Under any circumstances, it is recommended that these risks should be undertaken on the principle of mutuality; for the absolute guarantee, at fixed rates, for risks of so uncertain and varying a character would lead to evils as great as those which at present exist. For instance: the losses by hail in France were, in 1839, 117,000,000 fr. (£4,680,000); in 1830, 46,000,000 fr. (£1,840,000); in 1831, 54,000,000 fr. (£2,160,000); in 1844, 57,000,000 fr. (£2,280,000); in 1845, 50,000,000 fr. (£2,000,000); but, for the year 1826, the losses were only 22,000,000 fr. (£880,000); in 1833, 21,000,000 fr. (£840,000); in 1850, 12,000,000 fr. (£480,000); in 1851, 15,000,000 fr. (£600,000).

The inundations of 1840 and 1846, of which the first caused losses amounting to 42,000,000 fr. (£1,680,000), and the second, 39,000,000 fr. (£1,560,000), appeared as if they could not be easily surpassed; yet, in 1856, these losses were doubled, and even trebled, whilst in some years they do not exceed 3, 4, or 5 millions of francs damage (£120,000 to £200,000).

A still greater irregularity exists in the annual losses of cattle by contagious diseases. M. Loiset, in a Report to the Constituent Assembly (*Moniteur*, 8th May, 1849), recalls the frightful losses occasioned throughout Europe by the contagion to which cattle were subject in 1711, 1740, 1770, 1796, and 1815. In the period comprised between 1711 and 1796, the agricultural interest is computed, by Dr. Faust, to have lost, in France and Belgium, 10 millions of heads of cattle, equivalent in value to 2 milliards (£80,000,000).

From 1827 to 1846, pleuro-pneumonia has carried off, in the Département du Nord alone, 212,800 cattle, the value of which may be reckoned at about 52 millions of francs (£2,080,000).

The losses by frost present results still more uncertain. In some years, entire departments, the fourth or the third part of France, are subjected to total loss. How, then, could the Government, which has to prepare its statement of receipts and expenditure from year to year, run the risk of fluctuations so great by guaranteeing against these dangers at a fixed rate! The Government, would, in fact, be forced to the necessity of protecting itself by demanding a tax much greater than is really necessary to meet the losses and expenses of administration. Thus, in 1848, when the Government of the Republic entertained the design of undertaking the whole fire insurances of France, the rate was fixed at 1 franc per 1,000 (*see* the statement of M. Duclerc, then Minister of Finance, at the sitting of the Assemblée Nationale, 15th June, 1848); although it might be demonstrated that, if the whole 120 milliards of francs which constitute the value of fire insurable property in France (£4,800,000,000) were insured, the losses and bare expenses could be met by a contribution of 29 centimes per 1,000 francs (7*d.* per £100). The difference, which would have been a surcharge if the proposition of M. Duclerc had been carried, amounted to no less than an annual tax against the insured of 85,200,000 fr. (£3,408,000).

If such would have been the effect of fire insurance by the State, greater still would be the relative tax imposed if it were to undertake the classes of risks, such as hail, inundation, &c., in which the fluctuations being greater, the probability is that the real charge would be at least doubled; and, as the annual average losses in the four classes under review amount to 100 millions of francs, another 100 millions (£4,000,000) would be the extra tax levied on the assured.

But, it may be objected, if assurance be not obligatory no one will insure. The motives urging to it, however, will be sufficiently apparent—(1) because it is proposed that the Government should guarantee the good administration and the proper distribution of the large capital stock which will be annually received for the payment of the current losses and the reserves; (2) that the regulations of assurance should be well defined and the right of each assurer in the common fund well guaranteed; (3) that the classification of the risks be carefully effected, and no kind of property be liable to a tax beyond the value of the risk to which it is actually exposed—the want of such classification having been hitherto the principal cause of the want of success in hail and cattle insurance in France.

With these conditions, landed proprietors would be soon attracted to the advantages of the system; and the farmer, even if he were himself indisposed, would probably soon be compelled by the owner of land to avail himself of it. The article 1769 of the Code Napoléon, which permits an allowance to the tenant of a part of the rent if he has lost the whole, or even half, of his harvest by fortuitous causes, would inspire in the landlord the thought of requiring the farmer to insure, and would cause the insertion of some such binding clause in all the agricultural leases.

And, lastly, it is evident that when the assurance of agricultural risks is placed upon a firm footing, the cultivators of land will be unable to obtain advances upon credit, either from individuals or public institutions, except upon the condition of insuring his crops and his cattle, which are often the only security he has to offer.

There would then be some hope, when the practice of such insurance has become common and its benefits understood, of making it obligatory—a measure which would be an oppression to the already over-burdened farmer if the classification of risks were defective, and the contributions, in however small a degree, beyond the rate which would suffice to meet the loss.

A few general rules may be laid down, such as are essential for the classes of agricultural risks and yet differ in some respects from the ordinary statutes of Mutual Societies:—

1. These funds, being under the sanction of Government, ought to embrace within the limits of insurance every object exposed to the risk, because, when once established, private Companies would have no chance of success in a similar sphere of action. Thus, hail insurance would include the risk of breakage of glass in greenhouses, &c.; insurance against inundations would be extended to houses, buildings, &c., in town or country, with the furniture they contain, grain, provisions, agricultural materials, animals, &c.; insurance against mortality of cattle should include also animals used in trade, &c.

2. The proprietor or cultivator of lands should be under the obligation to insure the whole value of his property exposed to risk—the whole of his crops, grass, grain, fruit trees, vines, wood, and agricultural produce whatever, if against the risks of hail; his house, crops, merchandise, &c., against inundations; all the animals used in his business, horses, oxen, cows, pigs, sheep, &c., if against the mortality of cattle. This would be necessary, to increase the number and the values insured, and prevent the risks falling only on the most dangerous classes of objects.

3. There should be a rule that no indemnity would be given where the loss was less than one-tenth part of the total value of the same kind of crops; and when the loss is in excess of that amount it should always be first deducted. This rule only to apply to each class of produce, not to the total value of all the agricultural stock.

4. As to the rates of contributions, they comprise the payments for losses and the costs of management of the Society—distinguishing therein the charges of administration, to afford comparison of the saving effected over existing Mutual Societies of a similar kind. The latter need not exceed 50 centimes per 1,000 francs. The Mutual Hail Insurance Companies at present receive 1.50 fr. to 2.50 fr. per 1,000 fr., and the Cattle Insurance Societies so much as 5 fr. per 1,000 fr. The contributions for losses are proportional to the values of the objects exposed to risk. Thus, vines insured against hail pay a higher contribution than corn, because they are more liable to damage; corn proportionably more than grass; olives and tobacco more than vines. The costs of administration should be distributed in similar proportions, the only way by which the lower classes of risks can be tempted within the range of assurance.

Various other regulations, as to the use of the reserved fund and of the mode of paying losses so as to preserve the equitable rights of all the mutual assurers, are suggested by M. le Hir, but we proceed rather to the classification of the risks and the experience gained by observation.

I. *Hail insurance.*—Experience demonstrates that storms are subject to certain laws, by which their course is directed, not according to general zones, but in certain sinuous paths, varying greatly in width—so that the

risks arising from hail cannot be estimated by zones, nor by departments, nor arrondissements, nor cantons, but only by communes. Societies for mutual assurance against hail have long since discovered that some localities are more exposed than others to this risk, but not possessing the elementary statistics necessary to determine and assort the risks, they adopted, at first, the distribution by zones or departments. Finding the insufficiency of this arrangement, they endeavoured to remedy it by deciding that, in the first instance, the contributions of each department should be applied to cover the losses peculiar to itself, and the surplus only carried over to other departments in which the operations of the Societies extended; but so long as the contributions of departments which were less exposed were not diminished thereby, it merely served to demonstrate the defects of the system; and no system of assurance could become popular or well established in which the premiums for the risks were not better proportioned.

When the division by zones or departments is not based upon the experience of the Societies themselves, it is usual to regulate the risks by the more northern or southern locality. Thus, France is divided for this purpose into departments "du Midi," "du Centre," or "du Nord"; but the result of statistical inquiries proves the falsity of this classification. Thus, in the number of the departments in which hail is least prevalent, are the departments "du Centre"—La Vendée (standing only 4th in the 86 departments), Les Deux Sèvres (9th), La Loire Inférieure (13th), Maine et Loire (14th), La Haute Vienne (18th), L'Yonne (22nd), and the southern departments, Les Pyrénées Orientales (10th only), La Corse (15th), Le Gard (21st), Le Var (26th), Les Bouches du Rhône (35th), &c.; and amongst the departments in which hail is most prevalent are other departments "du Centre"—Le Rhône (86th), Saône et Loire (81st), Haut Rhin (73rd), Loir et Cher (71st), and even the northern departments, such as Le Nord (53rd), Le Pas de Calais (40th). There ought, at least, to be a further division of the departments on the sea coast; and, even then, if in the greater part hailstorms are but little experienced, there are some which contradict the rule, as Le Nord, Le Pas de Calais, La Charente Inférieure, and, especially, La Gironde (which is 83rd in order).

Again: if the statistics be arranged according to amount of losses in each department, it is likely to deceive; for in departments which are rich, and teeming with produce of greater value, such as La Gironde, Le Rhône, the value of the losses may be considerable and yet the actual number of losses be less than in departments apparently less exposed.

The same irregularities will be observed even in arrondissements, cantons, and communes of the same department, rendering the division by zones or by departments almost impossible; and is it probable that anyone who has for 30 years observed that, not only his commune, but his canton, or even his arrondissement, has not been visited with this plague, would submit to be heavily taxed for the benefit of another? If the contribution was light, he might be induced to assure, not otherwise.

La Société Mutuelle de Toulouse, consulting its own experience, adopted, in 1853, the system of classification by communes, based on the statistical results for 10 years, collected in the communes "du Midi," where its operations are carried on.

The division by communes was also taken, in 1848, by M. Duboucheron, as one of the two bases of the classification of hail risks for l'Union

Générale; but, as no distinction was made between the communes devastated once and those in which hailstorms had never occurred, those subject to the smallest risks were deterred from insuring, and the best and most numerous class of business was consequently lost.

The Compagnie Générale d'Assurance, in 1854, was induced to obtain an authorisation to carry on hail insurance business at fixed rates of premium, which it would never have ventured upon but for the true classification of the risks by communes.

The regulation of the risks by locality in communes, and according to the number of times each commune, or the canton and arrondissement in which it is situated, has been struck, offers the great advantage of allowing the lowest risks to be rated at their true value. It is evident that a commune never struck, situated in an arrondissement never struck, runs less risk than a commune never struck which is situated in an arrondissement struck one or more times; and that the degree of risk may be estimated according as a commune never struck is more or less distant from others frequently exposed to risk.

The following table (Table I.) embodies these observations on the division of agricultural risks into classes and according to the risk of locality—the rate per cent. being set against each commune relative to the degree of risk to which it is exposed for various classes of produce; and the agent, being furnished with the position in the scale of each commune in his district, is enabled at once to quote the corresponding premium.

Thus, there are 224 communes in France situated in arrondissements which have never been struck with hail. These communes, according to the table, would pay for the 1st class of agricultural produce—viz., meadow lands, potatoes, beet-root, &c.—only 4 centimes per 100 francs of value insured; for the 2nd class, corn, &c., they would pay only 14 centimes.

By the same table, out of 2,078 communes situated in cantons not struck, the most heavily charged would only pay, for the 1st class of produce, 10 centimes per 100 francs; and, for the 2nd class, only 35 centimes per 100 francs. At this rate we might reckon on insuring the communes even the least exposed to risk in France.

As to communes only struck once by hail, and thus warned of the advantages of insurance, they would only pay, for corn, &c., 70 centimes per 100 francs, a contribution which is by no means extravagant.

The rates for still heavier risks are proportionately low, and yet the costs of management are included.

In order to demonstrate that these contributions are sufficient, it is assumed that the 8th and 9th ranks represent together the mean rate, and from this the following summary is deduced for the total receipts for insurance according to the value of agricultural produce of each class, the total of all being assumed as 6 milliards of francs (£240,000,000):—

Class I.—Total estimated value, 1,600 millions of francs (£64,000,000), which, at 19 centimes per 100 fr., the mean of 8th and 9th ranks, gives, annually	Fr.	£
Class II.—Total value, 2,700 millions of francs (£108,000,000), insured at 665 per 100 fr., gives, annually	3,400,000 =	136,000
	17,955,000	718,200
Carried forward	21,355,000	854,200

Brought forward	21,355,000	854,200
Class III.—Total estimated value, 660 millions of francs (£26,400,000), insured at 95 centimes per 100 fr.	6,270,000	250,800
Class IV.—Total estimated value, 1,000 millions of francs (£40,000,000), insured at fr. 1.425 per 100 fr.	14,250,000	570,000
Class V.—Total estimated value, 40 millions of francs (£1,600,000), insured at fr. 1.90 per 100 fr.	760,000	30,400
Total product of contributions, including charges	42,635,000	1,705,400
Deduct charges for management for the 6 millions of francs, at 5 centimes per 100 fr.	3,000,000	120,000
Leaving for actual losses and other expenses of the Society	39,635,000	1,585,400

This sum is reckoned to be amply sufficient, since the losses by hail do not amount annually to more than 35 or 36 millions of francs on an average. The statistical returns previously alluded to, for the 26 years, 1826 to 1851 inclusive, represent the losses by hail to be 984,292,849 fr., or an average of 35,153,316 fr. (about £1,400,000).

The calculations above given are based upon the number of communes struck or not struck previous to the end of 1851. Since then, 1,100 more cases of visitation by this scourge have occurred in communes, and a considerable augmentation of the contributions would be required; but if, in the first instance, they should be somewhat high, they might afterwards be reduced as experience permitted. The classification by communes would, of course, be liable to changes and corrections. Thus, a commune struck for the first time would have to be placed in its proper topographical position, and future contracts be thereafter governed by the corresponding rates, without prejudice to existing contracts. It would be the duty of the council of administration to revise and regulate the classification of the communes from year to year, according to the number of times which they suffer from hail; and to rectify errors or omissions from time to time, by amending the new contracts entered into, but not disturbing the old.

II. *Insurance against Frosts.*—The losses by frost which have been relieved by Government aid amounted, from 1826 to the end of 1851, to 217 millions of francs (£8,680,000), or about 8 millions of francs (£320,000) per annum; but no claim was made for indemnity for heavy losses of this kind from about 20 departments, amongst which may be noticed the Départements du Midi, de la Corrèze, de la Gironde, du Gard, de l'Hérault, des Bouches du Rhône. In 1830 the frost occasioned more than 29 millions of francs (£1,160,000) losses. In the Bouches du Rhône the olive harvest was entirely destroyed. The losses, from 1826 to 1851, were, according to the formal statements for this department, 31 millions of francs (£1,240,000); for the Département de l'Hérault, 26 millions of francs (£1,040,000); for the Département du Gard, 16 millions of francs (£640,000); and for the Département de la Gironde, 10 millions of francs (£400,000). There are only 8 millions of francs (£320,000) for La Corrèze, and there are only 20 departments in which the losses by frosts exceeded 2 millions (£80,000) in the 26 years—that is to say, 66 departments have continued much below the average of 100,000 fr. (£4,000) per annum.

Nevertheless, it is quite certain that great ravages are caused by frost in the departments of the centre and the north of France, upon the cereals, and especially upon the potato crops, at a particular period of growth. The cultivators of these crops, perhaps, are not so ready with complaints, because the effects of the frosts being principally felt when the plants are young, the immediate loss may be repaired by a change of temperature, or because the season may allow of a fresh sowing and the renewal of the crop.

It must also be considered, that sometimes the seasons are so intemperate as to cause a general destruction not to be included within the usual limits of assurance, such as drought or continued rains. The consequence may be a scarcity, which may enhance the price of grain; and as the price rises in a much greater proportion than the diminution of the crop, the cultivator may not be so great a loser as at first sight appears.

These considerations give rise to the reflection that it would be better to restrict this class of assurance to certain plants, such as vines, olives, &c.; or, rather, that the assurance should only be undertaken as an experiment, for if it happened that a frost should occur which would affect the greater part of France, the fund might be subjected to demands far beyond the capabilities of ordinary assurance, and great embarrassment would be the result.

But if insurance against frosts is to be extended to all the crops liable to be affected, it would include the agricultural products insurable against hail, deducting therefrom meadow lands, woods and forests, and reducing the insurable property from 6 to 4 milliards (£240,000,000 to £160,000,000).

As to the annual losses occasioned by frost, there can be no doubt that they greatly exceed the amount declared to the prefects of departments. There is every reason to think, that, if they were fully proved, they would exceed the losses by hail; but, considering the period of the year in which the effects would be generally felt, the damage might, at least, partly be repaired. Making allowance for these deductions, the amount of annual indemnity required for the restoration of the damage may be safely computed at about 20 millions of francs (£800,000).

The amount of total insurable value being 4 milliards, and the losses 20 millions of francs, the contribution to meet the losses would be about 5 fr. in 1,000 fr. of values insured; and, adding 50 centimes for cost of management, the full charge would be 5 fr. 50 c. per 1,000 fr. = 11s. per cent.

III. *Insurance against Inundations.*—There is no occasion to defend the topographical distribution of this kind of risk. It is evident that the more frequently a commune has been subject to inundation, the more liable it will be to a recurrence of the event.

But the classification by communes is not in itself sufficient, since in those most liable to inundations there are localities which, by their elevation, are altogether, or almost, free from its effects.

Those localities which are entirely free may be considered as not likely to be brought within the limits of insurance. As to those parts which are more exposed, it must be left to the judgment of the committee for the arrondissement, or of the general manager, to class them according to their situations, 1, 2, or 3 degrees, or more, below the average of the whole commune.

The following table (Table II.) exhibits, according to the nature of the assurable values and the situation of the commune, the contribution applicable to each degree of risk, including the cost of management.

TABLE II.—*Classification of Products, &c. for Insurance against the Risks of Inundation, showing the Rate per Cent., including Costs of Management.*

	(1) Communes not suffered.	(2) Suffered Once.	(3) Twice.	(4) Three times.	(5) Four times.	(6) Five times.	(7) Six times.	(8) Seven times.	(9) Eight times.	(10) Nine times.	(11) Ten times.	(12) Eleven times or more.
Number of Communes which have suffered, from 1826 to the end of 1851	—	5,344	2,165	1,008	591	358	342	153	37	48	23	46
Class I.—Lands, plains, meadows, &c. washed away or destroyed . . . . .	.01	.03	.04	.05	.06	.07	.08	.09	.10	.11	.12	.13
Class II.—Forests, trees, hedges, and cut wood . . .	.02	.06	.08	.10	.12	.14	.16	.18	.20	.22	.24	.26
Class III.—Buildings, houses, enclosures, walls, &c.	.03	.09	.12	.15	.18	.21	.24	.27	.30	.33	.36	.39
Class IV.—Borders of rivers and canals, dykes, & constructions in masonry connected with rivers, and boats . . . . .	.04	.12	.16	.20	.24	.28	.32	.36	.40	.44	.48	.52
Class V.—Constructions floating on rivers, or built on piles therein . . . . .	.05	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65
Class VI.—Herbage and harvests, natural or arti- ficial meadows, plants used for fodder which are not in general destroyed by inundation till nearly ripe (except plants grown for seed) . . . .	.06	.18	.24	.30	.36	.42	.48	.54	.60	.66	.72	.78
Class VII.—Furniture, clothing, moveable effects, or moveable farm utensils . . . . .	.07	.21	.28	.35	.42	.49	.56	.63	.70	.77	.84	.91
Class VIII.—Cattle, horses, poultry, &c. in farm- yard or stables . . . . .	.08	.24	.32	.40	.48	.56	.64	.72	.80	.88	.96	1.04
Class IX.—Harvests in barns—provisions and merchandise not easily removed, and likely to be entirely destroyed by inundation . . . . .	.10	.30	.40	.50	.60	.70	.80	.90	1.00	1.10	1.20	1.30
Class X.—Vines, orchard trees, and shrubs . . . .	.12	.40	.60	.80	1.00	1.20	1.40	1.60	1.80	2.00	2.20	2.40
Class XI.—Other products—cereal crops, rape seed, marsh products, garden crops, &c. . . . .	.16	.60	.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.30	3.60

The figures in the preceding columns represent the number of communes exposed to the risk of inundation in each year from 1826 to the end of 1851, forming a total of 10,010 communes. Several of these communes have been entirely inundated; others only partially. From these data we will endeavour, in the following summary, to ascertain what portion of the property of France, fixed or moveable, is subject to this plague. The two first columns give, by approximation, the quantity and value of insurable property, and the third the contribution equivalent to each class of value if it was situated in a commune only once smitten. This proportion has been taken as being rather below the real average, since, out of 10,010 communes, 5,344 only were smitten but once. Since 1851, the number of losses by inundations has increased. The fourth column shows the total contributions for values insured.

	Fr.	£	At per cent.	Fr	£
Class I.—Superficial products liable to be washed away (the value of cultivated lands in France is 60 milliards of francs)	2,000,000,000	= 80,000,000	·03	600,000	= 24,000
Class II.—Woods (the revenue of France in woods, was, in 1841, 200 millions of francs, or a capital of 5 milliards)	180,000,000	7,200,000	·06	108,000	4,320
Class III.—Buildings	1,850,000,000	74,000,000	·09	1,665,000	76,600
Class IV.—Borders of rivers	100,000,000	4,000,000	·12	120,000	4,800
Class V.—Floating buildings	8,000,000	320,000	·15	12,000	480
Class VI.—Grass, hay (the green crops and hay of France were estimated, in 1841, at 900 millions of francs)	200,000,000	8,000,000	·15	360,000	14,400
Class VII.—Furniture, clothing (for the whole of France there are, at least, 10 milliards of francs)	312,000,000	12,480,000	·21	655,200	26,208
Class VIII.—Cattle	250,000,000	10,000,000	·24	600,000	24,000
Class IX.—Harvests housed, merchandise (the harvests housed in all France are worth about 6 milliards of francs; merchandise, at least as much)	2,000,000,000	80,000,000	·30	6,000,000	240,000
Class X.—Vines (the vines were worth, for all France, according to the statistics of 1841, 400 millions of francs)	100,000,000	4,000,000	·40	400,000	16,000
Class XI.—Cereal and other products (for all France, valued at 4 milliards of francs)	1,000,000,000	40,000,000	·60	6,000,000	240,000
	8,000,000,000	320,000,000		16,520,200	660,808

According to these statistics, the contributions for insurance against inundations would produce 16,520,200 fr.; but, considering that there is a much higher value smitten twice and upwards than what has never suffered at all, we should raise this total to at least 19 millions; from which, deducting 4 millions for the charges of administration of 8 milliards at 10 centimes, there would remain 5 millions (£600,000) as a sufficient sum to meet the annual risks and costs of the Society.

According to the statistical returns, the actual average of losses caused by inundations, from 1826 to 1851, was 11,284,493 fr. (about £451,380), and even this is considered an exaggerated statement. The inundations of 1856, which caused losses amounting to about 140 millions of francs (£5,600,000), have greatly augmented this average, but would not, probably, bring it above 15 millions of francs.

V. *Insurance against Mortality amongst Cattle.*—M. Loiset, in his Report to l'Assemblée Nationale, in 1849, fixed the annual average of these losses at 40 millions of francs (£1,600,000), but this may be deemed somewhat exaggerated, and that 35 millions (£1,400,000) would be nearer the truth. The proprietor, however, would be himself on the risk to the extent of one-fifth, and the salvage might amount to one-twentieth, which would reduce the net loss to 26,250,000 fr. (£1,050,000).

The following table gives the contribution for each degree of risk, the insurable value in each class, and the annual product of the contributions. According thereto, it will be seen that

	Fr.	£
The total annual contributions would amount to at least	28,000,000	= 1,120,000
From which, deducting charges of administration, at		
5 centimes per 100 fr., on 2 milliards of value	1,000,000	40,000
	<u>27,000,000</u>	<u>1,080,000</u>

there would remain more than sufficient to meet an annual loss of 26,250,000 fr. (£1,050,000), and the other expenses of the Company.

	Contributions per cent.	Value of each Class.		Total Amount of Contributions.	
		Fr.	£	Fr.	£
Class I.—Horses, mules, asses, oxen employed in agricultural labour, milch cows at pasture or stalled in the country, goats, horses, and mules, for saddle or harness	1	1,000,000,000	= 40,000,000	10,000,000	= 400,000
Brood mares, cows, &c.	1	96,000,000	3,840,000	960,000	38,400
Class II.—Pigs	1	200,000,000	8,000,000	2,000,000	80,000
Class III.—Sheep, lambs	2	400,000,000	16,000,000	8,000,000	320,000
Class IV.—Horses of the gendarmerie and officers of the army	1½	4,000,000	160,000	60,000	2,400
Class V.—Horses and mules for riding or draught, oxen for draught; stallions, bulls, and rams; milch cows kept out of the towns	2¼	150,000,000	6,000,000	3,375,000	135,000
Class VI.—Horses and mules belonging to carriers, the mail post diligences, public vehicles or barges, or livery stables; milch cows kept in towns or their environs . .	3	150,000,000	6,000,000	4,500,000	180,000
		<u>2,000,000,000</u>	<u>80,000,000</u>	<u>28,895,000</u>	<u>1,155,800</u>

But the risk of mortality should not be exclusively calculated on the class of animals employed or the nature of the work in which they are

engaged, but regard should be had, to a certain extent, to the localities which they inhabit, and especially to the conditions of nourishment, care, and shelter which they receive.

For these circumstances, the regulations prescribe an increase or diminution of the rates—the council of administration diminishing, by one to two-fifths, the contributions of the communes which, since 1826, have not, according to the statistics in the possession of the Society, been once subject to an epidemic malady. The rate may be diminished by one-fifth only if the commune during the same period has been only once visited by an epidemic, and where the health of the cattle is generally good.

The rates may be increased by one-fifth if, since 1826, the commune has been visited by epidemics 2 to 4 times; by two-fifths, if from 5 to 8 times; by three-fifths, if from 8 to 12 times; by four-fifths, if from 13 to 18 times; and, if more than 18 times, the rates may be doubled.

There is no reason to fear that the power of diminishing the rates is likely to lead to the general product of the revenue being inadequate to meet the annual losses and expenses, since the cases of augmentation will be much more numerous than those of diminution; and, whilst the former is obligatory, the latter is only permissive.

General remarks.—At the present time, out of 6 milliards of francs (£240,000,000) of agricultural produce exposed to risk from hail, no more than 200 millions (£8,000,000) are assured.

Of cattle and other agricultural stock, valued at 2 milliards of francs (£80,000,000), only 10 millions (£400,000) is covered by insurance.

Insurance against inundations is unknown, as yet, in France; so also is insurance against frosts.

The rates for agricultural produce insured against hail, are, in general, averaged at $1\frac{1}{2}$ per cent., yet the losses are far from being completely provided against; but, according to the system of classification now proposed, the assured would only pay annually for the lowest rate against hail and in communes the least exposed, 4 centimes per 100 fr. (4 in 10,000), including the charges of administration; whilst the average contributions would amount to no more than $66\frac{1}{2}$ centimes (less than half the present average).

Cattle, &c., insured against epidemics by existing Societies, pay, on an average, $4\frac{1}{4}$ per cent. of value; and yet, for the most part, the indemnity is less than the loss. By the scheme now proposed, the rate would be 1·24 per 100 fr. value of agricultural stock; and it may be reasonably expected that a vast increase of insurance would result therefrom.

	Fr.	£
By present rates, the 6 milliards of francs of insurable value against hail would cost		
90 millions of francs; and the 2 milliards of cattle insurance another 90 millions	180,000,000	= 7,200,000
By the scheme proposed, the premiums would be only 30 millions of francs for hail, and 27 millions for cattle insurance	66,000,000	2,640,000
Annual saving to agriculturists	114,000,000	4,560,000

Yet, in the latter case, the indemnities would not fail to be paid in full, because the total of the annual contributions exceed, by several millions of francs, the annual average losses and the total costs of administration.

As for the rates of insurance against inundations, they would be equally

light, since, for insurable values the most likely to be destroyed by inundations, such as the cereal crops, &c., the average would be under 60 centimes per 100 fr.

The rates for insurance against frosts, if well regulated, and the risk properly defined, would be equally moderate.

The Government distributes, every year, amongst those who suffer from ordinary losses by hail, frost, inundation, cattle epidemics, fire and other accidents, 2 millions of francs, independent of those extraordinary cases of such calamities for which special funds are voted. To this we must add as much more for remission of taxes, or about 4 millions of francs for ordinary relief. But, from 1838 to 1853, the amount of ordinary losses reported to the Minister was 1 milliard and 84 millions of francs. If we compute, then, the relief accorded by the Government at 4 millions a year, the total for that period would only be 64 millions, or 3·42 per cent., a scarcely appreciable part of the damage occasioned.

The adoption of the system proposed would be a veritable boon to France; and the establishment of insurance at its true rate, and the very considerable reduction for the lower class of risks, would draw in a vast amount of property now uninsured.

At present, the farmer who has seen his crops perish, or his flocks and herds swept away by epidemics, has no resource but in borrowing; and loans, often usurious, can lead to nothing but decline and ruin.

By insurance, the most disastrous losses are immediately repaired; and the establishment of a sound system for the benefit of agriculture would be, in France, an honour to the age in which it was created and to the Government by which it was founded.

CORRESPONDENCE.

THE PAMPHLET RECENTLY PUBLISHED BY THE SCOTTISH EQUITABLE SOCIETY.

To the Editor of the Assurance Magazine.

SIR,—The pages of the *Assurance Magazine* are fortunately not often occupied with the discussion of topics relating to particular Companies, and I should not have ventured to ask you to deviate from your usual practice in this respect, by inserting this letter, did I not feel that some notice should be taken of a pamphlet circulated amongst Insurance Offices, purporting to be *A Statement, by the Directors of the Scottish Equitable Life Assurance Society, to the Members of the Society, relative to the Case W. C. Fowler and others v. the Scottish Equitable*. I say the pamphlet purports to be a statement by the Directors, for I can hardly believe that any board of directors would have adopted the questionable practice which the writer of this pamphlet has done, of condemning every person who has the misfortune to differ with him in opinion on the merits of this case.

The Scottish Equitable is one of those Offices which announces that its “policies may, after being of five years’ endurance, be declared indisputable on any ground whatever, and the assured be entitled to travel or reside

beyond the limits of Europe without payment of extra premium for such travelling or residence. Special application must be made to the directors for such privileges however, and satisfactory evidence adduced, that, at the time of his application, the assured has no prospect or intention of going beyond the limits of Europe."

Why a period of five years should be a better limit than any other, would, perhaps, be difficult to explain; but there seems to be no doubt, in the minds of the judges of our courts of law and equity, as to the force of the term "indisputable." Perhaps this was the point of attraction with Messrs. Rees and Co. when they effected this insurance, and they have not been the first to realise the value of the benefit conferred upon the public.

The simple facts of this case appear to be, from the directors' statement (for none other has come under my notice), that the life assured died 180 miles beyond the limits of the policy. At first there seems to have been some doubt whether the policy was voided or not; but, on inquiry being made of one of the "most eminent geographers," the place of death was said to be 350 miles beyond the limits. This "most eminent geographer" was afterwards found to be "out" in his measurement, and the question of avoidance as to distance is ultimately fixed at 180 miles. But the directors say their decision would not have been affected by the distance; the assured had no licence, and hence the Society was absolved from payment. Again: the directors say—"Mr. Fowler being aware of the disinclination of the Equitable Society" (I suppose they mean the "Scottish" Equitable Society) "to enter into a lawsuit, threatened them with proceedings. It does not seem to have occurred to the directors, that, if their licence had been exceeded, they were entitled to an extra premium; but no, "they considered the question at issue to be one of vital importance, and they accordingly adhered to their resolution of declining to pay."

Of vital importance the question undoubtedly is, for it must be borne in mind that this policy was held by an assignee; that of the *bonâ fide* nature of the assignment no question is raised by the Directors; that it never was in the hands of the life assured, and it was all along held by parties who had no control over his movements. In fact, so ignorant were they about him, that the assignment to Mr. Fowler bears date "a month after Mr. Haire's death."

If, then, what should be a valuable instrument becomes a piece of waste paper, when the contract is taken strictly upon its legal construction, it behoves us to inquire whether this is a specimen of the practice of a particular Office, or if it is generally adopted.

We are told that "the Scottish Equitable, or any other respectable Office, never think of declaring a policy forfeited where the party may have gone beyond the prescribed limits, perhaps by mistake, provided the fact be instantly intimated to them, and the additional premium paid." Somehow or other, there is always an ugly proviso in these Scotch concessions. Here it is *provided* the fact be *instantly* intimated; in the indisputable declaration, the party may go anywhere, *provided* he has no intention of going. But, whatever the Scottish Equitable may do, it must be satisfactory to the public to learn that respectable English Offices adopt a much more liberal course. It is well known that many of the leading English Offices will, when asked to do so, place an endorsement upon their policies, providing, amongst other things, for the contingency which has happened in this particular instance. The endorsement sets forth, that, should the life assured

do any act or thing contrary to the conditions of the policy, the insurance shall not thereby be rendered void, if the interested party make the communication as soon as the fact comes to his knowledge, and pays the additional premium which would have been required if the fact had been known at the time it had occurred.

Such, then, being the London practice, as distinguished from the Edinburgh profession, it may fairly be asked, "Is it just and right to place a policy-holder, who has so much confidence in the Office he insures with as not to ask for such an endorsement to be put upon his policy, in a worse position than one who exhibits a want of confidence by insisting upon having this qualification to the conditions of his policy?" Under any circumstances, the equity of the case would have been met by the payment of an extra premium, but the forfeiture of the policy can only be justified where an attempt at fraud is detected.

The directors take credit for having paid claims that appeared to be more than doubtful. Do they imagine that their Society is the only one that has done the same? Have not many Offices at times good reason to suspect they have been imposed upon? To suspect is one thing; to be able to prove the suspicion to be correct is another. If Offices, in their anxiety to do business, fail to make due inquiries before they enter into contracts, they must expect to pay for their want of caution. According to the theory of an old insurance director, no one ever came to insure his life until he had had a runaway knock. This suspicion led him to regard those who did come to insure as his natural enemies.

Now let us sum up the charges which the directors make against Mr. Fowler and the other parties who appear in this dispute.

That Mr. Fowler "*has printed and circulated a pamphlet in which, by the most unscrupulous assertions, and equally unscrupulous suppressions, he endeavours to make out that the directors have improperly resisted his claim, and that it ought still to be paid.*"

This charge of *suppressio veri* is somewhat strong, and does not seem justified by the subsequent details in the directors' pamphlet. The latter part of the charge the directors appear to have proved for themselves.

Next, Mr. Koenig, a member (as the directors acknowledge) of a respectable firm in Liverpool, is charged with making "false and calumnious statements against the directors," and with having a bad memory.

Then Mr. Haire's antecedents are questioned; afterwards the English courts of equity are treated with a blessing, and Vice-Chancellor Sir John Stuart with something else, for giving credence to Mr. Koenig's affidavit, and for ordering the Society to refund all the premiums they had received on this policy.

Then the members of the Society are referred to the *Times* of a particular date for an estimate of Sir John Stuart's decisions. The directors are strongly advised to appeal to a court of review; but as they had no wish to make a profit of the transaction, they declined to follow the advice; and they had concluded that the business was at an end, but they find that "Mr. Fowler, having failed to accomplish his end by legal means, seems determined now to attempt it by illegal ones. He has printed a pamphlet on the subject, which is one tissue of falsehoods from beginning to end, and transmitted a copy of it to each of the ordinary directors, with the cool request that they, to save him trouble and expense, would furnish him with a list of the policy-holders, to enable him to send copies of it to them also."

Mr. Fowler has, no doubt, found it impossible to procure a list of the members, even at a sacrifice of trouble and expense, without the aid of the directors, which aid they intimate they have withheld; and yet, with the usual consistency displayed in their pamphlet, it is headed "*Audi alteram partem.*"

They (the Directors) say that "*the only plea maintained by the Society was, that Mr. Haire, having gone beyond the limits of the licence, the policy had been forfeited; and that plea was held to be a true and fair one, and it has been given effect to.*"

By whom, it may be asked, was the plea held to be true and fair? It was, no doubt, held to be good in law, and hence its effect. The Vice-Chancellor made the Society refund the premiums, which the directors never offered to do. After this, perhaps the less said about fairness the better.

"*The directors do not believe that the memorandum was written by Mr. Kœnig at the dictation of Mr. Cook.*"

Mr. Kœnig says it was. Mr. Cook is not here to deny it. The Vice-Chancellor leans to the side of Mr. Kœnig, and the memorandum certainly seems to bear unmistakeable evidence of official wording.

Mr. Fowler is charged with suppressing the words "save as aforesaid"; and the directors add, "*After this, it will scarcely be credited that Mr. Fowler's pamphlet contains a fair statement of the case.*"

A fair statement, indeed! How can the directors hazard such a remark when they have previously asserted "*that the pamphlet is one tissue of falsehoods from beginning to end,*" and that Mr. Fowler supports his claim "*by the most unscrupulous assertions and equally unscrupulous suppressions?*"

The directors suggest that it is, perhaps, unnecessary to advert to the opinions expressed by other persons upon this claim; nevertheless, they cannot help looking upon one Mr. Macbryde's *interference as a piece of gross impertinence*; and one of their extraordinary directors (a very "extraordinary" director, indeed) is rebuked for giving an opinion adverse to the Society, upon an *ex parte* statement. This gentleman is now in possession of the directors' version. Will he alter his decision? Other opinions, adverse to the directors, are referred to, but they insinuate that Mr. Fowler took care to frame his statement so as to secure a favourable response.

What a bad fellow this Mr. Fowler must be!

The directors say, in conclusion, that if this claim ought to have been paid, no other similar claim ought to be resisted. I can only hope we may never see another such claim resisted, except, as before observed, upon the plea of fraud. Would it not have been better for the directors to have deducted the extra premiums the Society was entitled to, and to have handed the balance to the assignee of the policy? and will it not be better for the Society to practise indisputability, instead of professing it?

Let this catchpenny term be erased from the prospectuses of those Offices who have been so ill-advised as to adopt it, and perhaps we may see, at no distant day, a return to that confidence in the insurance institutions of the country which some Offices have, of late years, done their best to destroy.

I am, Sir,

Yours truly,

PHILO-SCOTLÆ.

London, September, 1859.

THE
ASSURANCE MAGAZINE,
AND
JOURNAL
OF THE
INSTITUTE OF ACTUARIES.

On the Law of Mortality and the Construction of Annuity Tables.
By WILLIAM MATTHEW MAKEHAM, Esq., of the Church of
England Assurance Institution.

MOST writers on the subject of life annuities have had occasion to lament the paucity of tables available for the performance of calculations involving two or more lives. The late Mr. David Jones has done much to supply this deficiency by the publication of complete sets of tables for two lives at various rates of interest; but, beyond this, it is extremely improbable that, under the present system, any considerable progress will be made, owing to the multiplicity of the different combinations when three or more lives are concerned, and the consequent magnitude of the task involved in the construction of complete sets of tables for such cases.

It is scarcely necessary, I presume, to enlarge to any great extent upon the advantages of a ready and expeditious mode of computing *accurately* the values of annuities on three or more lives, according to a certain predetermined table of mortality, in preference to the usual methods of approximation at present adopted for the purpose of avoiding calculations of formidable length. Although the values deduced by such methods of approximation, in many instances, are, perhaps, as near the *truth* as the values correctly deduced would be, yet it is generally felt that, having assumed a certain table of mortality as the basis of calculation, it is desirable that the results attained should be strictly consistent with that basis—in short, that our *conclusions* should be in accord-

ance with our *premises*. *Granted* that such a rate of mortality and such a rate of interest will obtain, *then* such a sum, and no other, is the value of the given annuity or other contingent benefit. To this very proper regard for logical consistency, which is the foundation of mathematical science, we owe the construction of tables of annuities certain to five or six decimal places; for it cannot be pretended that *any* assumed rate of interest represents the real value of money so exactly as to render such extreme accuracy at all necessary to the abstract justice of the case.

The chief object of the following investigation has, therefore, been to find a formula which should represent with sufficient accuracy the results of observations on the law of mortality; and which, at the same time, should be adapted to facilitate the construction of *complete* sets of tables of annuities involving several lives.

PART I.—On the Law of Mortality.

It seems to be generally admitted, that the *theoretical* law of mortality propounded by Mr. Gompertz, although by no means a perfect representation of the *actual* law, at the same time is so nearly borne out by facts, as to render it highly probable that further progress in the investigation will be made in the track thus opened up; in other words, that practical improvements in the construction of mortality tables may be looked for in some modification of Mr. Gompertz's formula.

As the subject is more conveniently treated *logarithmically*, the theoretical law in question may be defined by stating that the logarithms of the probabilities of living over any given period proceed in geometrical progression.

To see how far this theoretical law is supported by experience, let us examine the following data, derived from three of the most approved mortality tables:—

Age.	1. CARLISLE TABLE.			2. EXPERIENCE.			3. GOVERNMENT ANNUITANTS.		
	Log. of Prob. of Living over 20 Years.	Log. ² of same.	Differences.	Log. of Prob. of Living over 20 Years.	Log. ² of same.	Differences.	Log. of Prob. of Living over 20 Years.	Log. ² of same.	Differences.
20	(—) ·07918	2·89862		(—) ·07427	2·87081		(—) ·10154	1·00664	
40	·14398	1·15830	+·25968	·14797	1·17017	+·29936	·15074	1·17823	+·17159
60	·58237	1·76520	+·60690	·63282	1·80128	+·63111	·54127	1·73341	+·55518

Now, if the Gompertzian theory were *strictly* true, the two terms in the column of differences would be equal; but, instead of this being the case, it appears that in each of the three instances the *second* difference is considerably greater than the *first*, which shows that the logarithms of the probabilities, instead of proceeding in uniform geometrical progression, increase (numerically) in a far greater ratio in the higher than in the lower ages.

But although the three terms in the first column do not obey the law assigned, yet they may be made to do so by the addition of a certain uniform quantity (x) to each term, such quantity being the numerical value of the following expression, in which the three given terms are denoted respectively by the letters a , b , and c :—

$$x = \frac{b^2 - ac}{a + c - 2b}.$$

The addition of this quantity to the *logarithms* of the probabilities is, of course, equivalent to multiplying the probabilities themselves by the number corresponding to the quantity added, considered as a logarithm; and the definition of the law of mortality becomes—"the probabilities of living, *increased or diminished in a certain constant ratio*, form a series whose logarithms are in geometrical progression."

I proceed to describe the method of deducing the rate of mortality at every age according to the law last defined, and to exhibit the results in comparison with those derived from actual observations, and also with the results deduced by means of Mr. Gompertz's formula.

Let π_x denote the probability of living one year at age x , and $\pi_x^{\bar{n}}$ the probability of living n years at same age; then the three quantities in the first columns of the foregoing table will be represented by $\log. \pi_{20}^{\bar{20}}$, $\log. \pi_{40}^{\bar{20}}$, and $\log. \pi_{60}^{\bar{20}}$. Further: let a^{20} stand for the quantity by which $\pi_{20}^{\bar{20}}$, $\pi_{40}^{\bar{20}}$, and $\pi_{60}^{\bar{20}}$, are to be multiplied in order that the law of geometrical progression may prevail, and let q^{20} be the common ratio of the three resulting terms. Now,

$$\begin{aligned} \log. \pi_{20}^{\bar{20}} &= \log. \pi_{20} + \log. \pi_{21} + \dots + \log. \pi_{39} \\ \log. (a^{20} \pi_{20}^{\bar{20}}) &= \log. (a \pi_{20}) + \log. (a \pi_{21}) + \dots + \log. (a \pi_{39}); \end{aligned}$$

and, by the assumed law of mortality,

$$\begin{aligned} \log. (a \pi_{21}) &= \log. (a \pi_{20}) \times q \\ \log. (a \pi_{22}) &= \log. (a \pi_{20}) \times q^2 \\ \&c. &= \&c.; \end{aligned}$$

whence

$$\begin{aligned}\log. (a^{20}\pi_{20}^{[20]}) &= \log. (a\pi_{20}) + \log. (a\pi_{20}) \times q \dots + \log. (a\pi_{20}) \times q^{19} \\ &= \log. (a\pi_{20}) \times \frac{q^{20}-1}{q-1} \\ \therefore \log. (a\pi_{20}) &= \log. (a^{20}\pi_{20}^{[20]}) \times \frac{q-1}{q^{20}-1};\end{aligned}$$

and having found, by the last equation, the first term of the series $\log. {}^2(a\pi_x)$, the successive terms are obtained by the repeated additions of $\log. q$, and the series $\log. \pi_x$ is then deduced by the simple subtraction of $\log. a$ from each term of $\log. (a\pi_x)$.

It remains now to test the proposed formula by its application to actual observations, for which purpose I select the well-known "Experience" mortality amongst assured lives. In this case, the data for the ages between 20 and 80 is by far the most important in comparison with the rest; first, because the observations on the ages not included between those limits are made upon numbers too small to give much weight to the deductions made from them; and, secondly, because the great mass of the calculations of an Assurance Office will be but slightly affected by errors in estimating the rate of mortality at the excluded ages. For these reasons, the following law of mortality has been deduced entirely from the observations on lives between the ages of 20 and 80, leaving the remaining portions of the table to be constructed on the assumption that the law so deduced may be taken to represent the true rate of mortality—say, from the age of 10 years upwards, to the extremity of human life.

The data derived from the Experience observations gives

$$\log. \pi_{20}^{[20]} = -.07427 = a,$$

$$\log. \pi_{40}^{[20]} = -.14797 = b,$$

$$\log. \pi_{60}^{[20]} = -.63282 = c.$$

Adding to each of these terms the quantity $\log. a^{20}$, deduced from the formula,

$$\log. a^{20} = \frac{b^2 - ac}{a + c - 2b} = .06106,$$

we have

$$\begin{aligned}\log. (a^{20}\pi_{20}^{[20]}) &= -.01321 & \log. &= \bar{2}.12091 \\ & & & + .81815 = \log. q^{20} \\ \log. (a^{20}\pi_{40}^{[20]}) &= -.08691 & \log. &= \bar{2}.93906 \\ & & & + .81815 = \text{do.} \\ \log. (a^{20}\pi_{60}^{[20]}) &= -.57176 & \log. &= \bar{1}.75721\end{aligned}$$

whence we obtain the following values of the constants used in the process :—

$$\begin{aligned}
 q^{20} &= 6.578850 & \log. &= .8181500 \\
 q^{20} - 1 &= 5.578850 & \log. &= .7465447 \\
 q &= 1.098772 & \log. &= .0409075 \\
 q - 1 &= .098772 & \log. &= \bar{2}.9946338 \\
 a^{20} &= 1.150959 & \log. &= .06106 \\
 a &= 1.007054 & \log. &= .003053 \\
 \log. (a\pi_{20}) &= -\cdot 000233883 & \log. &= \bar{4}.3689987.
 \end{aligned}$$

The following is a specimen of the actual process of finding the logarithms of the adjusted probabilities for each age :—

$$\begin{array}{rcl}
 & & (-) \\
 \log.^2(a\pi_{20}) &= \bar{4}.3689987 & \log. (a\pi_{20}) = \cdot 000233883 \\
 & \cdot 0409075 & \text{---} \cdot 000023100 \\
 \hline
 \log.^2(a\pi_{21}) &= \bar{4}.4099062 & \log. (a\pi_{21}) = \cdot 000256983 \\
 & \cdot 0409075 & \text{---} \cdot 000025384 \\
 \hline
 \log.^2(a\pi_{22}) &= \bar{4}.4508137 & \log. (a\pi_{22}) = \cdot 000282367 \\
 & \cdot 0409075 & \text{---} \cdot 000027889 \\
 \hline
 \log.^2(a\pi^{23}) &= \bar{4}.4917212 & \log. (a\pi_{23}) = \cdot 000310256 \\
 & \cdot 0409075 & \text{---} \cdot 000030645 \\
 \hline
 \log.^2(a\pi_{24}) &= \bar{4}.5326287 & \log. (a\pi_{24}) = \cdot 000340901 \\
 & \&c. & \&c.
 \end{array}$$

The differences of the series $\log. (a\pi_x)$ are here taken out, and the value of $\log. \pi_{20}$ being found by subtracting $\log. a$ from the first term of the series (viz., $\log. a\pi_{20}$), the successive addition of the differences gives the several values of $\log. \pi_x$ thus :—

$$\begin{aligned}
 \log. (a\pi_{20}) &= -\cdot 000233883 \\
 -\log. a &= -\cdot 003053000 \\
 \hline
 &= -\cdot 003286883 = \log. \pi_{20} \\
 \Delta &= -\cdot 000023100 \\
 \hline
 &= -\cdot 003309983 = \log. \pi_{21} \\
 \&c. & \&c.
 \end{aligned}$$

I now beg to direct the reader's attention to the following table, showing the annual mortality amongst 1,000 persons entering upon each year of age from 20 to 80; first, from the actual experience of the 17 Offices; secondly, from the Actuaries' Adjusted Table based upon it; thirdly, from the formula herein described; and, lastly, from Mr. Gompertz's own formula.

Annual Mortality per 1,000.

Age.	Expe- rience.	Actuaries' Adjust- ment.	New Formula.	Gom- pertz's Formula.	Age.	Expe- rience.	Actuaries' Adjust- ment.	New Formula.	Gom- pertz's Formula.
20	12.38	7.29	7.55	3.74	50	16.30	15.94	15.99	21.10
21	10.95	7.38	7.59	3.97	51	17.20	16.90	16.87	22.36
22	5.95	7.46	7.66	4.20	52	18.95	17.95	17.85	23.64
23	8.51	7.56	7.71	4.46	53	18.52	19.09	18.91	25.06
24	6.74	7.67	7.78	4.72	54	18.12	20.31	20.08	26.51
25	7.67	7.77	7.87	5.00	55	24.92	21.66	21.34	28.08
26	7.15	7.89	7.94	5.30	56	24.46	23.13	22.76	29.74
27	8.94	8.01	8.05	5.61	57	22.01	24.68	24.29	31.48
28	7.71	8.14	8.14	5.95	58	23.98	26.39	26.00	33.30
29	5.27	8.28	8.25	6.30	59	30.10	28.25	27.86	35.28
30	7.19	8.42	8.37	6.68	60	30.13	30.34	29.89	37.32
31	7.65	8.58	8.51	7.07	61	32.83	32.61	32.12	39.52
32	6.09	8.75	8.67	7.49	62	31.64	35.12	34.55	41.81
33	9.48	8.92	8.83	7.94	63	35.30	37.84	37.24	44.24
34	8.88	9.10	9.01	8.41	64	48.20	40.83	40.18	46.83
35	10.57	9.29	9.19	8.91	65	45.29	44.08	43.40	49.55
36	9.55	9.48	9.42	9.43	66	47.81	47.61	46.92	52.43
37	10.08	9.69	9.65	10.00	67	44.93	51.47	50.77	55.44
38	9.95	9.91	9.92	10.59	68	57.35	55.63	54.98	58.67
39	9.57	10.13	10.19	11.21	69	62.05	60.09	59.61	62.05
40	11.61	10.36	10.51	11.88	70	75.53	64.93	64.64	65.63
41	10.80	10.61	10.85	12.58	71	70.72	70.16	70.13	69.41
42	10.56	10.89	11.24	13.33	72	67.20	75.80	76.15	73.36
43	10.61	11.25	11.65	14.11	73	79.36	81.88	82.72	77.58
44	11.75	11.70	12.13	14.95	74	91.82	88.47	89.88	82.03
45	12.17	12.21	12.63	15.86	75	100.54	95.56	97.68	86.67
46	10.99	12.84	13.18	16.76	76	102.35	103.18	106.16	91.59
47	13.06	13.52	13.79	17.78	77	102.08	111.47	115.41	96.79
48	16.56	14.26	14.45	18.79	78	134.55	120.44	125.44	102.26
49	14.85	15.06	15.17	19.92	79	134.69	130.06	136.35	108.01

It will be seen, by inspection, that the numbers in the third column follow very fairly the original and adjusted data in the first and second; while the last column, obtained by the application of Mr. Gompertz's formula *unmodified*, exhibits so little conformity with the original data, as to render it totally unfit to be adopted as a substitute.

I proceed, in the next part, to show how the method of construction herein proposed may be made of considerable utility in forming a complete set of annuity tables involving two or more lives.

PART 2.—On the Construction of Annuity Tables.

It will be convenient to abandon the logarithmic form hitherto adopted, and pursue the subject with the aid of the characters denoting simple quantities.

The following equations are deduced directly from the assumed law of mortality as defined in the first part.

$$\begin{aligned} a\pi_n &= a\pi_n \\ a\pi_{n+1} &= (a\pi_n)^q \\ a\pi_{n+2} &= (a\pi_n)^{q^2} \\ &\dots\dots\dots \\ a\pi_{n+r-1} &= (a\pi_n)^{q^{r-1}}; \end{aligned}$$

whence $a\pi_n \times a\pi_{n+1} \times \dots \times a\pi_{n+r-1} = a^r \pi_n^{\bar{r}} = (a\pi_n)^{\frac{q^r - 1}{q - 1}}$.

Let $B_n = (a\pi_n)^{\frac{1}{q-1}}$, and we have $a^r \pi_n^{\bar{r}} = \frac{B_n^{q^r}}{B_n}$.

consequently, if v^r be the value of £1 (certain) due r years hence, the value of £1 contingent on a life aged n years surviving the term of r years will be $\left(\frac{v}{a}\right)^r \cdot \frac{B_n^{q^r}}{B_n} = \frac{B_n^{q^r}}{B_n} s^r$ (putting $\frac{v}{a} = s$). The value of an annuity, payable in advance, on a life aged n years, will, therefore, be represented by

$$\frac{1}{B_n} (B_n + B_n^q s + B_n^{q^2} s^2 + B_n^{q^3} s^3 \dots \text{ad infin.}) \quad [1];$$

and, similarly, the value of an annuity on two joint lives aged respectively m and n , by

$$\frac{1}{B_m B_n} \left(B_m B_n + (B_m B_n)^q t + (B_m B_n)^{q^2} t^2 + \dots \right) \quad [2],$$

$$\text{where } t = \frac{v}{a^2}.$$

In seeking for a suitable modification of Mr. Gompertz's formula, it is, of course, highly desirable to avoid introducing any unnecessary intricacy. Now, it will be observed that the additional constant, a , enters in the formula precisely in the same way as the element of *interest*, which may almost in practice be said to form an inseparable part of it; and consequently, that, for all practical purposes, the proposed modification does not alter the *form* of the function deduced by Mr. Gompertz.

If the two lives be of the same age, p , the value of the annuity becomes

$$\frac{1}{(B_p^3)} \left\{ (B_p^2) + (B_p^2)^q t + (B_p^2)^{q^2} t^2 + \dots \right\} \quad [3].$$

Comparing this with the formula [2], it will readily be seen that the value of an annuity on the two lives aged m and n will be the same as the value of an annuity on the two equal lives aged p , provided that $B_m B_n = B_p^2$. The same property, of course, holds good for any number of lives. Thus, the value of an annuity on three joint lives, each aged p , is

$$\frac{1}{(B_p^3)} \left\{ (B_p^3) + (B_p^3)^q z + (B_p^3)^{q^2} z^2 + \dots \right\},$$

which is also the value of an annuity on any other combination of three lives, aged respectively i , k , and l , provided

$$B_i B_k B_l = B_p^3.$$

The property in question, as I shall now proceed to show, gives the power of constructing a table of the *correct* values of annuities for any given number of lives (according to the law of mortality before explained), with a considerably less expenditure of time and labour than is required in constructing a complete set of tables for two lives only according to the usual method.

Taking the q th power of each side of the equation $B_n = (a\pi_n)^{\frac{1}{q-1}}$, we have $B_n^q = (a\pi_n)^{\frac{q}{q-1}}$; but $(a\pi_n)^q = a\pi_{n+1}$, wherefore $B_n^q = (a\pi_{n+1})^{\frac{1}{q-1}} = B_{n+1}$, and, generally, $B_n^{q^t} = B_{n+t}$; consequently, $(B_m \cdot B_n)^{q^t} = B_{m+t} B_{n+t}$, and $(B_p^2)^{q^t} = B_{p+t}^2$; from which it appears that if $B_p^2 = B_m B_n$, then $B_{p+t}^2 = B_{m+t} B_{n+t}$; and, therefore, having found p , the common age equivalent to m and n , the common age equivalent to $(m+t)$ and $(n+t)$ will be $p+t$. Now, let m be the younger of the two ages m and n , and let $p = m + d$, then $p + t = (m + t) + d$; that is, the addition which must be made to the younger age m , to give the equivalent common age p , is the same which must be made to the younger of any other two ages where the difference is the same, viz., $n - m$.

I annex (Table I.) an extract from a table of annuities on two lives of *equal* ages, according to the proposed law of mortality, constructed in the usual way, but having the values of every tenth part of a year's difference in age inserted by interpolation. The latter process is rendered comparatively easy, by the fact that the values of annuities at consecutive ages are nearly in arithmetical progression. The further subdivision of the ages, when necessary, can be performed by the aid of the column of differences.

Before the table so formed can be used for finding the values of annuities on combinations of unequal ages, we must have a table showing the addition, d , to be made to the younger of two ages whose difference is k , in order to give the equivalent common age. Assume the younger age $= o$, then

$$B_o^2 = B_o B_k \therefore (B_o^{q^d})^2 = B_o (B_o^{q^k}),$$

$$\text{or } B_o^{2q^d} = B_o^{1+q^k}, \text{ whence } 2q^d = 1 + q^k,$$

$$q^d = \frac{1 + q^k}{2}, \text{ or } \log. q \times d = \log. \frac{1 + q^k}{2},$$

$$\log. \frac{1+q^k}{2},$$

$$\therefore d = \frac{\log. \frac{1+q^k}{2}}{\log. q},$$

by which formula the values of d_x in the annexed table have been computed.

In a similar way, it may be shown that, in the case of three lives, if k and l denote the differences between the youngest and the other two ages respectively, in order to find the equivalent common

age we must add to the youngest age the quantity $\frac{\log. \frac{1+q^k+q^l}{3}}{\log. q}$.

To calculate the value of this expression for every combination of k and l would be a work of considerable labour, but by means of a table of the values of q_x (*vide* Table II.), the quantity in question may be easily computed in any particular case. The annuity table for three, or indeed any number of lives, would, of course, be found precisely in the same way as the table for two lives, and would require, in its construction, the same amount of labour, and no more.

TABLE I.—Two Joint Lives (*Extract*).

Common Age.	Annuity.	Difference.	Common Age.	Annuity.	Difference.
		(—)			(—)
39·1	13·4751	229	39·6	13·3601	232
39·2	13·4522	229	39·7	13·3369	232
39·3	13·4293	230	39·8	13·3137	233
39·4	13·4063	231	39·9	13·2904	233
39·5	13·3832	231	40·	13·2671	234

TABLE II. (*Extract*).

x .	$\log. q^x$.	q^x .	d_x .	x .	$\log. q^x$.	q^x .	d_x .
11	·4499825	2·818270	6·865	16	·6545200	4·513568	10·766
12	·4908900	3·096635	7·612	17	·6954275	4·959381	11·591
13	·5317975	3·402495	8·376	18	·7363350	5·449229	12·429
14	·5727050	3·738566	9·158	19	·7772425	5·987458	13·280
15	·6136125	4·107830	9·954	20	·8181500	6·578850	14·143

I conclude with an example of the actual process of determining from the table the value of an annuity on two joint lives, and also of the equivalent common age in a case of three lives. The corresponding annuity in the latter case would, of course, be found from the table of three lives in precisely the same way as the annuity on the two lives.

Example 1.—Required the value of an annuity on two joint lives aged respectively 30 and 45.

Here, $k=15$ and (Table II.) $d_{15}=9.954$; wherefore the equivalent common age $=39.954$. By Table I. we find the value of an annuity for the age $39.9=13.2904$, and the corresponding difference for one-tenth of a year $=-.233$. Therefore,

$$\begin{array}{r} 13.2904 \\ 233 \times .5 = 117 \\ 233 \times .04 = 9 \\ \hline .0126 \\ \hline 13.2778 = \text{value required.} \end{array}$$

Example 2.—Required the common age equivalent to the three ages, 25, 40, and 45,

Here, $k=15$, $l=20$.

$$\begin{array}{r} 1. \\ q^{15} = 4.10783 \\ q^{20} = 6.57885 \\ 3 \overline{) 11.68668} \\ 3.89556 \quad \log. = .59057 \\ \log. q = .04091 \\ \therefore d_{15, 20} = \frac{.59057}{.04091} = 14.436 \end{array}$$

and common age required $=39.436$.

On the Rationale of certain Actuarial Estimates. By CHARLES JELlicoe, Actuary to the Eagle Insurance Company.

[Read before the Institute of Actuaries, 28th November, 1859.]

SOME three or four years ago, I submitted to the members of the Institute a few observations on the valuation of property held for life and in reversion, and on the due apportionment of it when questions arise between the life tenant and the owner of the fee.* I was induced to bring this subject under the notice of the members from observing the great difference of opinion prevailing in regard to it generally, and especially in the discussions on the subject of church leases and of other property similarly circumstanced—in

* See volume vi., page 61.

which discussions no sort of agreement appears to have been come to as to the true principles upon which the value of the interests of the several parties concerned should be estimated. In the paper in question, I endeavoured to point out some of these principles; and my object now is to enlarge somewhat on the arguments therein laid down, to show that the question at issue almost always resolves itself into one whether a property is to be bought or sold, to call attention to the vast difference in value which arises under the two conditions, and to point out the imperative character of the causes from which this difference originates; finally, to urge the necessity of great care and circumspection in dealing with the questions submitted to us, so that all risk of confounding one of the conditions above referred to with the other may be avoided.

It is rather a fortunate circumstance that, in most of the properties which form the subject of our investigations, good reasons can be assigned for the selling as well as for the purchasing value of them. It is probably true that every description of property has these two values, but it would be, in most cases, difficult to assign satisfactory reasons for either of them or for their difference; with securities dependent on the duration of human life it is not so; and I now proceed, accordingly, to cite a few instances of such values, and to point out, briefly, the reasons why they differ so materially as they do.

Let us first suppose that a well-secured annuity of £100, on a given life, is to be sold; the question immediately arises, At what rate can the life be assured? and this being determined, and the rate of interest also settled, the price is known. For the purpose of comparison, we will assume the rate of premium to be £3 per cent., and that of interest to be £5; and we accordingly find, from Mr. Sprague's useful table,* that the annuity should fetch about £1,188.†

We will now reverse the case, and suppose that an annuity of the like amount is wanted. To obtain it, as we know, the pur-

* See page 18 of this volume.

† The formula in this case being, as is well known, $100 \left(\frac{1}{d+p} - 1 \right)$.

Since, however, annuities are now, in accordance with the provisions of an Act of Parliament passed some years ago, almost always paid to the day of death, a still more simple formula is applicable, in that case, for determining their market value. Thus, the sum advanced is represented by $1-p$; and since the annuity for this is $p+i$, we have, for the value of £1 annuity, $\frac{1-p}{p+i}$; since $p+i : 1-p :: 1 : \frac{1-p}{p+i}$.

chaser must apply to the Government Office or to a well-established Annuity Company; and, assuming that the life is of the same age as before, it will be found that about £1,684 must be paid for it.*

In this instance, we observe that the purchasing price is no less than 50 per cent. in advance of the selling one; and we shall presently see that it is rather matter of surprise that the difference is not still greater. Of course, the reason of the discrepancy, as it exists, is, that anyone selling or granting such a property must guard against an extreme longevity and a fall in the rate of interest; whilst a person buying it has to provide against the premature death of the annuitant, and to secure the usual rate of interest on his investment; and the attainment of these objects involves charges which affect the value of the security in the manner described.

Let us now see how a property simply reversionary fares under the like circumstances, and assume that £1,000, receivable at decease of a person of the age before supposed—viz., 40—is to be sold. The intending buyer will conclude that the life in question is a good one or the owner would not sell, and, as he will have long to wait for the return of his capital, he will expect to realize a high rate of interest. If he be skilful in such matters, he will see what an annuity, to pay interest on his capital while it is alienated, will cost, and thence be guided as to the price he should pay. In any case, he will probably offer about £264, and he will find that others will be disposed to offer the same.†

But a very different state of things arises if a property of this description has to be purchased. To obtain it without delay, recourse must be had to an Assurance Company, who will treat the application as for an assurance at a single premium, and, having satisfied themselves that the life to be assured is an eligible one, will, no doubt, ask much about double the sum above mentioned.‡

Now this sum—say £528—results from a calculation which supposes interest to be realized at $3\frac{1}{4}$ per cent., and an annuity on

* The formula being $100A$ simply, say at $3\frac{1}{4}$ per cent. Carlisle mortality.

† That is to say, the value found by the formula $1000 \cdot \frac{1-rA}{1+r}$ Carlisle mortality and interest at 6 per cent, or by the formula $1000 \cdot [1-d(1+A)]$, where A is at $3\frac{1}{4}$ per cent. and d at $4\frac{1}{2}$ per cent.; interest in such an arrangement being actually realizable immediately, and the risk of extreme longevity thrown on others.

‡ Namely, $1000 \cdot \left(\frac{1-rA}{1+r} \right) + \phi$, where r and A are at $3\frac{1}{4}$ per cent., and ϕ is an addition for expenses, &c.

the life to be worth 16·84 years' purchase, an arbitrary addition being made for expenses and profit. But, as we have seen, an annuity can be purchased at the rate above quoted without any addition at all, whereas, on a parity of reasoning, the price of it should be increased from 15 to 20 per cent. This comparative cheapness in the annuity market can, I think, be accounted for only by the fact that the Government, the largest dealers in it, do not look for any profit or contribution to expenses, and that others dealing in the like commodity are, of necessity, compelled to regulate their charges by those of the Government. The unprofitable character of the business comprised in the granting of annuities is strongly illustrated by these considerations, which would, indeed, seem to preclude all private transactions in it, unless under circumstances which render the immediate command of capital unusually advantageous.*

Let us now investigate the conditions which regulate the buying and selling prices of a contingent reversionary sum, and, for this purpose, suppose that a reversion is to be sold of £1,000, payable at decease of a person aged 70, if another, aged 40, survive. As before, a purchaser will first ascertain the cost of insuring the younger life against the elder, and, after providing for this and

* Reversionary property consists so commonly of stock in the funds, that a few words as to the future value of it may, perhaps, be said here without irrelevancy. It is very much the practice to assume that Consols will, at any future time, most probably realize 85 per cent; and this assumption is grounded on the fact that that has been the average price for about half a century together (*see* chapter 2 of Mr. Griffith Davies' work). But I think the assumption is a fair one, considering that $3\frac{1}{2}$ per cent. is about the true rate of interest for a security perfect in every respect, with the exception of the circumstance that the amount recoverable is always uncertain. An investment in Consols has, with this exception, all the characteristics of a perfect security. It is as safe as anything can well be, interest is paid with entire punctuality, and the capital can be lent or withdrawn, at the will of the lender, almost at a moment's notice. The exception we have spoken of is the only defect, but it is a serious one, and demands at least half per cent. more in the rate of interest. It is probable that Consols would always be nearer 100 per cent. if it were not for this peculiarity—that is to say, that no more than 3 per cent. per annum would usually be obtained from an investment in them. But if 85 per cent. be a fair rate for the purposes we are speaking of, there seems no reason why the 3 per cent. stock of an Assurance Company should not be taken in its valuations at that rate, rather than at any of the rates arising from such other principles of valuation as those enumerated by Mr. Farren (*see* vol. 5, page 318); and we may observe, that, if such a practice be acted upon, it follows that every purchase of such stock at a higher rate than 85 per cent. must involve a loss.

for the usual rate of interest, will find that he can offer for such a contingent security about £530.* Here, it will be observed, that, although the security is contingent, it is, to suit the exigencies of the market, rendered absolute—the purchaser recovering his capital at decease of either of the lives; and, therefore, in order to contrast the selling price in this case with that of the purchasing one, we must ascertain the cost of the reversion in question receivable also at decease of either of the lives. Now, it will be found that the sum demanded by a respectable Company, in this case, will be about £870, or more than 50 per cent. increase on the selling price;† and, since the conditions under which such a reversionary interest is purchased will be the same as those applying to one which will contrast with the proceeds of the sale of a contingent reversionary annuity as well as of a contingent reversionary sum, we may use it for the purpose in our inquiry on that head. Now, the exigencies to a purchaser of such an annuity are, the premium for assuring the younger life absolutely (not contingently), and interest for advances whilst both lives are in being; and these being duly considered, it will be found that a buyer cannot offer more than £450‡ for an annuity of this kind, the redemption-money for which is £1,000—the discrepancy, here, in the two prices, being nearly as great as any between those with which we have hitherto dealt.

Without, however, entering into further illustrations, we may easily perceive that a similar difference will exist in the selling and purchasing price of annuities and reversions on joint lives, the longest of two or more lives, and many other combinations of the

* Namely, 1000. $[1 - (d + p)(1 + AB)]$, where d is at $4\frac{1}{2}$ per cent. interest, being receivable immediately, and AB at $3\frac{1}{4}$ per cent., its cost price; or, $1000 \left(\frac{1 - rAB}{1 + r} - A^B \right)$, where the first quantity within the brackets is at 6 per cent., interest being supposed to be deferred and the risk of extreme longevity retained, and the second represents the actual cost of the contingent assurance as granted by a safe and respectable Company. (See paper “On the Contrivances required to render Contingent Reversionary Interests Marketable Securities,” vol. ii., p. 159.)

† That is to say, $1000 \cdot \frac{1 - rAB}{1 + r} + \phi$; AB and r being taken at $3\frac{1}{4}$ per cent., and ϕ being an arbitrary addition for expenses, &c., at the rate usually demanded by the particular Company.

‡ Found from the formula $\frac{1}{d + p} - (1 + AB)$, where p is the whole life premium and d and AB are at the market rates of 5 per cent. and $3\frac{1}{4}$ per cent. respectively. (See paper at page 159, vol. ii., before referred to.)

like description; and that all these securities assume features of quite a different character accordingly as they are regarded as being for sale or for purchase.* Hence the great importance of a clear understanding as to the manner in which they are to be viewed in the cases which may be submitted for our opinion.

As it may be useful to give one or two instances of the way in which a want of the needful information may operate, we will suppose a case to be stated as follows:—"You are requested to say what, in your opinion, should be given for an annuity of £100 on a life aged 40." The answer to this would seem to be properly based on the assumption that an annuity was to be sold, and the price to be given for it would be quoted accordingly. But we may suppose that executors are desirous of clearing an estate charged with such an annuity, and are willing to give the recipient of it a proper consideration for its surrender; and, in such a case, it is obvious that the answer to the question should be in accordance with the purchasing price, since the equivalent sum would be needed to place the annuitant in the position he was before. For want of a knowledge of the facts in such a case as this, an error might thus be made of £500 in an annuity of £100; and the injury inflicted, supposing the error not to be discovered, be of a very serious character.

Again: let the question be, "What is the present value of the reversion to £1,000 at decease of a life aged 40?" I believe most actuaries would not hesitate to give, in such a case, the usual value for sale—viz., the low one above referred to of £264. But it may easily be that the owner of a property charged with the reversion wishes to get rid of the charge, and is willing to give an equivalent for its surrender; in which case the high purchasing price is evidently the sum to be quoted as the value required, since it would not be reasonable that the owner of the reversion should be exposed to loss as well as trouble in the matter without a full equivalent. Now this higher price would be, as we have seen, about £528; so

* We may here observe, that the market value of policies of assurance is a good deal raised, from the circumstance of the Companies making (very properly) an allowance for their surrender. Were it not for the price which they give, it is to be inferred that these securities would not sell at so high a rate as they do. The sum assured, for example, would be regarded as an ordinary reversion for sale merely, whilst the premium would be looked upon as an annuity, the cost of which, in the market, would have to be set off against the value of the reversion; and, on these principles, it will be found that an assurance must be in force very many years before it can acquire any value at all.

that, in the instance of a reversion no larger than this, the applicants might be misled to the extent of £260, or thereabouts, for want of a proper understanding on the part of the actuary of the nature of the transaction. These instances may suffice to show the character of the errors which may be made in the course of our practice, and the necessity of exercising due care and circumspection to avoid them. To many of those I am addressing these precautionary suggestions are, no doubt, needless; but to those who are less practised in this peculiar portion of our professional occupations, they may not be altogether unserviceable.

On a Test for Ascertaining whether an Observed Degree of Uniformity, or the Reverse, in Tables of Statistics, is to be looked upon as Remarkable. By ROBERT CAMPBELL, M.A., Advocate, Edinburgh, Fellow of Trinity Hall, Cambridge.*

THE following problem was suggested by certain remarks in Mr. Buckle's introductory chapter to his *History of Civilisation*. In that chapter Mr. Buckle remarks upon the striking uniformity usually exhibited by classes of phenomena—such as not only births, deaths, marriages, but such things as those apparently depending upon mere caprice—such as the number of letters annually sent without directions through the Post-office, or those which appear likely to depend on the most capricious and irregular causes, such as murders and suicides; and he proceeds to draw certain moral conclusions from the fact of this uniformity, namely, the existence of certain moral laws, by which a section of the community, definite in number, is always impelled to such acts. But before entering upon a discussion of the legitimacy of such results, there appears to me always a previous question to be solved, namely, whether the observed degree of uniformity is *remarkable* or not. For supposing the observed uniformity to be not more than that which might be expected from events, the occurrence of which to individuals was conceived of as perfectly fortuitous, the whole argument would resolve itself into a pure metaphysical question, from which it would be hopeless to expect any practical issue.

I propose, therefore, the following problem:—To find some test by which we may ascertain whether a certain observed degree of uniformity, or the reverse, in tables which give the numbers yearly

* From the *Philosophical Magazine* for November, 1859.

occurring of a certain class of phenomena is to be looked upon as remarkable or not; and I propose the following method for finding such a test. Starting from the supposition that we know *nothing* except the total number of such phenomena which have occurred during a certain number of years, let us try to find the degree of uniformity with which we should expect the phenomena to be distributed through the different years. If the uniformity observed in the real tables is much greater than this, we may fairly conclude that there is some cause of this uniformity which we might hope to discover; and further, that if there is any known cause which might tend to produce such uniformity, we may fairly ascribe such uniformity, in part at least, to such cause; and if, on the other hand, we found the figures in the real tables to vary much more widely than we should expect from the knowledge of the mere fact from which we started, we might fairly say that the number in any year which presented such a remarkable deviation *is most likely* assignable to some disturbing cause acting in that particular year.

Such positive result will be matter of probability; but of this negative result we may be certain, that if the uniformity thus arrived at is very much the same as that of the real tables, we shall not be justified in drawing any moral inference from that uniformity alone; for it would be shown that such uniformity is only what is to be expected if we know *nothing* except the total sum of the tables.

Suppose, then, that with regard to the statistics of a certain class of phenomena *we know nothing*, except that during a series of a years the number of such phenomena has been found to be ab .

Suppose these to be phenomena presented by, or occurring to, individuals in a population of n persons, which we shall suppose, for the sake of simplicity, to remain nearly constant during the years in question. We will suppose also the phenomena of a kind which are not likely to occur to the same individual more than once in the same year. Of this class would be most of the important phenomena of which tables of statistics furnish numbers. Now, we suppose ourselves totally ignorant of the laws which regulate such phenomena, or rather we suppose it has never occurred to us that they might be regulated by any laws; therefore we do not conceive the same phenomenon to be more or less likely to be presented by the same individual in different years than by different individuals: consequently, we may conceive of the same individual in a different year, for the purposes of this problem, as a different individual.

Now, using the word "probability" in its technical mathematical sense, to say that *we know nothing* except the above datum, is the same as to say that the probability of a given person in a given year presenting the phenomenon is $\frac{b}{n}$. If we call this person A_1 , we may now say that the probability of A_1 presenting the phenomenon in the given year is $\frac{b}{n}$.

Now, suppose it known that A_1 presents the phenomenon in the given year: to find the probability of a second given person presenting it in the same year, we must remember that the number of remaining persons favourable to the supposition, any one of whom the person given might be, is $ab-1$, and the whole remaining number of persons is $an-1$. Therefore, calling the second given person A_2 , the probability of A_2 presenting the phenomenon in the given year is

$$\frac{ab-1}{an-1};$$

and the probability of his not doing so is

$$1 - \frac{ab-1}{an-1}.$$

Therefore the probability of A_1 presenting the phenomenon in any given year, and A_2 not doing so, is

$$\frac{b}{n} \left(1 - \frac{ab-1}{an-1} \right).$$

Now, suppose the persons alive in any given year to be $A_1, A_2 \dots A_n$, it will easily be seen, from the above, that the probability of the phenomenon in that year being presented by A_1 , and neither by A_2, A_3, \dots nor A_n , is

$$\frac{b}{n} \left(1 - \frac{ab-1}{an-1} \right) \left(1 - \frac{ab-1}{an-2} \right) \dots \left(1 - \frac{ab-1}{an-n+1} \right).$$

Hence the probability of *one person only* presenting the phenomenon in the given year is

$$b \cdot \left(1 - \frac{ab-1}{an-1} \right) \left(1 - \frac{ab-1}{an-2} \right) \dots \left(1 - \frac{ab-1}{an-n+1} \right) \dots \quad (1)$$

In a similar way, it may be shown that the probability of A_1, A_2 , both presenting the phenomenon in the given year, and neither $A_3, A_4 \dots$ nor A_n doing so, is

$$\frac{b}{n} \cdot \frac{ab-1}{an-1} \left(1 - \frac{ab-2}{an-2} \right) \left(1 - \frac{ab-2}{an-3} \right) \dots \left(1 - \frac{ab-2}{an-n+1} \right).$$

And the probability of *two persons only* presenting the phenomenon in that year is

$$\frac{n-1}{2} \cdot b \cdot \frac{ab-1}{an-1} \left(1 - \frac{ab-2}{an-2}\right) \left(1 - \frac{ab-2}{an-3}\right) \dots \left(1 - \frac{ab-2}{an-n+1}\right) \cdot (2)$$

The probability of *three persons only* doing so will be

$$\frac{(n-1)(n-2)}{2 \cdot 3} \cdot b \cdot \frac{ab-1}{an-1} \cdot \frac{ab-2}{an-2} \left(1 - \frac{ab-3}{an-3}\right) \left(1 - \frac{ab-3}{an-4}\right) \dots \left(1 - \frac{ab-3}{an-n+1}\right) \dots \dots \dots (3)$$

It is easy, therefore, to get the general formula, but it is only necessary to write down the most important one, which is, the probability of *b persons exactly* presenting the phenomenon in the given year. This is

$$\frac{(n-1)(n-2) \dots (n-b+1)}{2 \cdot 3 \dots b} \cdot b \cdot \frac{ab-1}{an-1} \cdot \frac{ab-2}{an-2} \dots \frac{ab-b+1}{an-b+1} \left(1 - \frac{ab-b}{an-b}\right) \left(1 - \frac{ab-b}{an-b-1}\right) \dots \left(1 - \frac{ab-b}{an-n+1}\right) \dots (B)$$

This expression would be obtained from that for the probability of $(b-1)$ persons doing so by multiplying it by the factor

$$\frac{n-b+1}{b} \cdot \frac{ab-b+1}{an-b+1} \cdot \frac{1}{1 - \frac{ab-b+1}{an-b+1}} \cdot \frac{\left(1 - \frac{ab-b}{an-b}\right) \left(1 - \frac{ab-b}{an-b-1}\right) \dots \left(1 - \frac{ab-b}{an-n+1}\right)}{\left(1 - \frac{ab-b+1}{an-b}\right) \left(1 - \frac{ab-b+1}{an-b-1}\right) \dots 1 - \frac{ab-b+1}{an-n+1}},$$

an expression which easily reduces itself to

$$\frac{n-b+1}{b} \cdot \frac{ab-b+1}{an-ab-(n-b)} = 1 + \frac{b(a-2)+n+1}{(n-b)(a-1)b}.$$

Except, therefore, in the anomalous cases of $a=1$ or $n=b$, which would be easily explained, this expression is always greater than 1.

In the same way, the ratio of the probability of $b+1$ being the number for the year, to that of b being so, is

$$\frac{n-b}{b+1} \cdot \frac{ab-b}{an-b} \cdot \frac{1}{1 - \frac{ab-b}{an-b}} \cdot \frac{\left(1 - \frac{ab-b-1}{an-b-1}\right) \left(1 - \frac{ab-b-1}{an-b-2}\right) \dots \left(1 - \frac{ab-b-1}{an-n+1}\right)}{\left(1 - \frac{ab-b}{an-b-1}\right) \left(1 - \frac{ab-b}{an-b-2}\right) \dots \left(1 - \frac{ab-b}{an-n+1}\right)},$$

so than those corresponding to the numbers below b . In the case of n not being very large, we should observe also, that the numbers increase *more* rapidly than when it is so. An application of this last observation may be the following:—Suppose that in a table of statistics the numbers were found more uniform than should be expected from the whole number of the community. The hypothesis that such phenomena are confined for the most part to a definite section of the community, might in some cases go far to explain such a uniformity.

It is easy to see how the expressions above given will, when worked out, afford a test such as was proposed in the outset. But probably a much more useful application of the problem will be, in the case of the extreme numbers which occur, to be able to tell whether their variation is such as to require explanation from the special circumstances of the particular year.

When we come to work out results numerically, we shall be probably startled at the extremely small probability of a number far removed from the average one which our results will give. It will be much more than in proportion to the moral surprise which it would give us to see such a number in the tables. Why is this? Simply because we started with the hypothesis that we knew *nothing* about laws regulating the phenomena and causing either uniformity or variety. Now this hypothesis was morally incorrect in this respect. For we knew *this* at starting, that such laws *may* exist; and if the degree of uniformity, or the reverse, in the real tables presents a striking contrast to that which we should expect from the result of our hypothesis, we may fairly be led to the conclusion that such laws *do* exist, and that our tables justify us in looking for causes to explain their remarkable features.

For example, take $a=5$, $b=242$, and suppose n large in comparison. (These are the figures referred to in Mr. Buckle's introduction as those representing the suicides in our metropolis for the five years 1846–50 inclusive; the numbers being in 1846, 266; 1847, 256; 1848, 247; 1849, 213; and in 1850, 229, as quoted from the *Assurance Magazine*.)

Our formulæ will then become—

$$\begin{aligned}
 a_1 &= \frac{5 \times 242 - 242 + 1}{4 \times 242} = \frac{969}{968}, \\
 a_2 &= \frac{\cdot \cdot \cdot \cdot \cdot}{\frac{969 \times 970}{968 \times 964}}, \\
 a_3 &= \frac{\cdot \cdot \cdot \cdot \cdot}{\frac{969 \times 970 \times 971}{968 \times 964 \times 960}}, \text{ and so on.}
 \end{aligned}$$

number less than 222 occurring," &c. : *e.g.*, to find the probability of a number between 212 and 220 inclusive occurring in a given year, "add the reciprocals opposite the numbers, divide by 9, and multiply the result by the probability of 242 occurring," &c.

I should suggest as likely to be a very useful application of the above, the solution of problems relating to the amount of capital requisite to ensure the stability of an Insurance Office with regard to fortuitous fluctuations, problems with regard to laying aside of bonus additions to policies, &c., especially where the statistics already obtained with regard to the particular class of risks are scanty.

The fundamental expressions receive another simplification if a is *large*; that is, supposing us to be supplied with tables extending through a great number of years. The expressions then become—

$$\begin{aligned} a_1 &= \frac{n-b+1}{b} \cdot \frac{b}{n-b}, \\ a_2 &= \frac{(n-b+1)(n-b+2)}{b(b-1)} \left(\frac{b}{n-b} \right)^2, \\ a_3 &= \frac{(n-b+1)(n-b+2)(n-b+3)}{b(b-1)(b-2)} \left(\frac{b}{n-b} \right)^3, \text{ and so on.} \\ a_1 &= \frac{b+1}{n-b} \cdot \frac{n-b}{b}, \\ a_2 &= \frac{(b+1)(b+2)}{(n-b)(n-b-1)} \left(\frac{n-b}{b} \right)^2, \\ a_3 &= \frac{(b+1)(b+2)(b+3)}{(n-b)(n-b-1)(n-b-2)} \left(\frac{n-b}{b} \right)^3, \text{ and so on.} \end{aligned}$$

These results might have been obtained more directly by neglecting a from the first. If the number of years was large, we should have very nearly the probability of A_1 presenting the phenomenon, and A_2 *not* doing so,

$$= \frac{b}{n} \left(1 - \frac{b}{n} \right), \text{ and so on.}$$

It has been found best to state the above problem starting from the point which suggested it; but, from the results obtained, it is thought the problem is capable of some more practical application. If the statements were strictly kept clear of all metaphysical ideas, what is proved amounts to this:—

If, among a set of n persons, an in number, there are ab who have some special peculiarity; then, if the persons are arranged in a sets (say, set 1st, 2nd, 3rd, &c.), each set containing n persons, and if this be done in all possible ways, the number of arrange-

ments which will throw exactly b of the peculiar individuals into a given set (say the 3rd), will be to the number of arrangements which will throw exactly $b-1$, $b-2$, &c., $b+1$, $b+2$, &c., of the persons into that set are as the numbers opposite (a_1) , (a_2) , &c., (a_1) , (a_2) , on pp. 320, 321.

In the following problem, we shall find the reciprocals of these more convenient for use. We shall call them (ϕ_1) , (ϕ_2) , &c., and (ψ_1) , (ψ_2) , &c.

Suppose we know that a set of $(a-1)n$ persons contains $(a-1)b$ of a particular class, and we take n more persons, whom we suppose individually as equally likely to belong to that class with the former; and let us suppose that they contain $b+ax$ persons of the kind required, and we want to find the probable limits of the value of x .

The whole an persons will contain $ab+ax$ of the required class, so that the average of that class in each set, if they were all divided into n sets, would now be $b+x$.

But supposing for an instant that we only knew that in the whole an persons the number belonging to the class was $ab+ax$; then the probability of the number $b+ax$ exactly of the class being in a given set (such as the set we supposed last taken in) would be to that of the number $b+x$ exactly being in the set, in the ratio

$$\{\psi_{ax-x}\}_{b+x}.$$

The $(b+x)$ below indicating that $b+x$ is to be written for b in the expression on p. 321.

And, writing $b+x$ for b in the expression for B , on p. 319, we have—

$$\left. \begin{array}{l} \text{Absolute probability of } b+ax \text{ exactly} \\ \text{of the class being in the set} \end{array} \right\} = \{\psi_{ax-x}\}_{b+x} (B)_{b+x}.$$

This will hold for any particular values of x , say $x=x_0$ and $x=0$; and, remembering that the hypothesis $x=x_0$ is the same as saying that $b+x_0$ is the average, and $x=0$ that b is the average, we have—

$$\left. \begin{array}{l} \text{Probability of } b+ax_0 \text{ exactly of the class} \\ \text{being in the set } (b+x_0 \text{ being the average)} \end{array} \right\} = \{\psi_{ax_0-x_0}\}_{b+x_0} (B)_{b+x_0}.$$

But the concurrence of the circumstances of $b+ax_0$ exactly of the class being in the set, with $b+x_0$ being the average, is the same thing as the concurrence of $b+ax_0$ being the number in the set, and of the other sets together containing $(a-1)b$. But the last is true by hypothesis: therefore—

$$\left. \begin{array}{l} \text{Probability of } b+ax_0 \text{ exactly of the class} \\ \text{being in the set, under the hypothesis} \\ \text{of the problem} \end{array} \right\} = \{\psi_{ax_0-x_0}\}_{b+x_0} (B)_{b+x_0}.$$

And, under the same hypothesis—

$$\frac{\text{Probability of } b + ax_0 \text{ exactly}}{\text{Probability of } b \text{ exactly}} = \frac{\{\psi_{ax_0 - x_0}\}_{b+x_0} (B)_{b+x_0}}{B}.$$

Now, if we had numerical values given for a and n , it might be possible for a limited number of values of x (say 1, 2, 3, 4, 5), to work out the above formula sufficiently for determining the above ratio approximately; and, in most cases, very few values worked out would be sufficient for any practical purpose, at least, if a is not less than 5 or 6.

On the Purchase of Life Assurance Policies as an Investment. By ARCHIBALD DAY, Actuary of the London and Provincial Law Assurance Society, and Fellow of the Institute of Actuaries.

[Read before the Institute of Actuaries, 2nd January, 1860.]

AN allusion made by Mr. Jellicoe to this subject, in a paper read before the Institute of Actuaries on the 28th November, has induced me to place on record the conclusions at which I had arrived after a somewhat recent consideration of the question.

It appears to me that the buyer of a policy by way of investment, in considering the price at which he should purchase, should come to his decision entirely independent of what might be the Office value. The two values have no connexion whatever one with another. In the one case the purchaser is about to make an investment; in the other, the Office proposes to redeem a liability.

The assumption is that the life on which the policy depends is an average one; or, at any rate, that the proposed purchaser knows nothing to the contrary. Speculations may, indeed, be made in the purchase of policies where the health of the life insured is known to be impaired; or prices exceeding the Office values may be paid for policies immediately prior to a division of profits, for the sake of surrendering them to the Office, after the declaration of bonus, at an increased price; but with these cases I do not now propose to deal. My present object is to show what sum should be given by a person contemplating a permanent investment and expecting to obtain a reasonable rate of interest for his money.

Viewing the question in this light, the purchaser of a policy has two things to consider—

1. The purchase of an absolute reversion payable on the death of a given life;

2. The grant of an annuity of the premium during the same life;

and, in fixing the price to be paid, he should be able to guard himself against loss in each transaction in the event of the life surviving beyond the average term.

To effect this, the reversion to the sum assured should be valued according to the modern formula, $1 - d(1 + A)$, d being at the rate of 5 per cent. ($= \cdot 04762$), and A representing the present value of an annuity on the life at a practicable rate of interest, say Carlisle $3\frac{1}{2}$ per cent. The value of the annuity of the premium should be taken at the same rate, being the price which would be demanded by a Society granting annuities to undertake the liability; the purchaser would then be safe in any event.

$$\begin{aligned} \text{Value of sum assured} &= S\{1 - d(1 + A)\} = S - Sd(1 + A) \\ \text{Value of future premiums} &= P(1 + A) \\ \text{Value of policy} &= S - (Sd + P)(1 + A) \end{aligned}$$

EXAMPLE.—*Policy for £500, effected at Age 40, without Profits.*
Annual Premium, £14. 7s. 6d.

At the expiration of	Value will be	One-third of Premiums paid.
10 years . .	Negative . .	£47·916
15 „ . .	£10·00 . .	71·875
20 „ . .	77·56 . .	96·500
25 „ . .	133·31 . .	119·792
30 „ . .	206·92 . .	143·750
35 „ . .	256·67 . .	167·710
40 „ . .	298·69 . .	191·666

The popular idea of the value of a policy “without profits” appears to be one-third of the premiums paid. In the example given above, the value does not reach one-third of the premiums until more than 20 years have elapsed; but, after that time, the excess of the value over one-third of the premiums increases rapidly.

It may appear paradoxical that a policy should have no value for nearly 15 years, and then but an insignificant one; but although it may have a value to the holder and to the Office, it would be a bad bargain to a person buying it as a permanent investment.

The purchase *might* prove a good speculation if the purchaser paid even a higher price, but he would have no *certainty* of making 5 per cent. interest on his outlay.

Objection is taken to this mode of valuing the reversion, that, in practice, a person buying a reversion seldom or never does go to a Company to purchase an annuity of the interest. But if we sub-

stitute the old tabular value, \mathcal{A} , a higher rate of interest must be assumed, and 6 per cent. will not then be deemed an exorbitant rate.

Valuing, then, the same policy by the formula $\mathcal{A} - P(1 + A)$, \mathcal{A} being at the rate of 6 per cent., and A , as under the former supposition, Carlisle $3\frac{1}{2}$ per cent.—

On the expiration of	Value will be
10 years	Negative
15 „	£17·687
20 „	77·65
25 „	127·59
30 „	188·23
35 „	245·38
40 „	286·725

results which do not differ materially from the previous values.

The foregoing has reference only to policies “without profits.” When, however, they are participating policies, any reversionary bonuses that have been declared would of course be treated as additional sums assured, but allowance must be made for those that hereafter may be declared. This can be done only by the roughest approximation. If, by the constitution of the Office, a policy which becomes a claim in the interval between two divisions of surplus, is entitled to bonus in respect of the period from the last division, the value of the respective annual additions to the sum assured would be represented by $\frac{R_m}{D_m} \times b$; and though the rate of bonus per annum (b) on the sum assured is in every respect an *unknown* quantity, it may not, perhaps, be unfair to assume it at the same rate as the average of the previous additions (if any) to the policy, especially as great differences exist between the bonuses of different Offices, so that a uniform rate can hardly be assumed.

If bonuses do not accrue except at the end of each quinquennial or septennial period, for $\frac{R_m}{D_m}$ must be substituted a series of deferred assurances, $\frac{M_{m+n} + M_{m+2n} + M_{m+3n}, \&c.}{D_m}$, multiplied by the average addition obtained at previous bonuses. It is important, however, to know whether the mode of dividing the surplus allots, at each division, a bonus in respect of every year from the date of the policy, or whether merely in respect of the years completed since the previous distribution.

In conclusion, I give an example of three policies, the sale of

which I happened recently to witness at the auction mart. In the estimated values, allowance has been made for future bonuses, in accordance with the method above proposed.

Date of Policy.	Name of Office.	Present Age.	Sums assured and Bonuses already declared.	Premium.	Estimated Value.	Sold for
Sept., 1822	A	83	2,920	£100 0 0	£1,893	£1,960
„ „	B	83	2,812	92 8 7	1,828	2,000
July, 1834	C	68	2,326	82 13 4	734	960

On the Medical Estimate of Life for Life Assurance. By STEPHEN H. WARD, M.D.*

(Continued from page 263.)

HAVING thus glanced at different occupations as elements in the medical estimate of life, it may not be out of place to introduce the following table by M. Lombard, exhibiting trades in relation to consumption. In 1,000 deaths in each of the different occupations noticed, the following proportions were furnished by this disease :—

With vegetable and mineral emanations	.	.	176
With various dusts . . . . .	.	.	145
With sedentary life . . . . .	.	.	140
With workshop life . . . . .	.	.	138
With hot and dry air . . . . .	.	.	127
With stooping posture . . . . .	.	.	122
With sudden movements of arms . . . . .	.	.	116
With muscular exercise and active life . . . . .	.	.	89
With exercise of the voice . . . . .	.	.	75
Living in the open air . . . . .	.	.	73
With animal emanations . . . . .	.	.	60
With watery vapour . . . . .	.	.	53

It may be further observed, that the better the condition of life, the less the liability to consumption. Marc d'Espine has proved that tuberculosis occasions 68 deaths per 1,000 among the rich, and 233 per 1,000 among the poor.

Residence.—There are but few points in regard to residence in this country which materially affect the value of life. Town life, though far healthier than it was a few years back, still falls far

* See Letter from Thomas Fraser, Esq., page 357.

short of country. "Taking," says Dr. Letheby, "the mortality of 15 in 1,000 as that which is natural to this country, and comparing it with that of 30 in 1,000 as that which occurs in some parts of the city of London, you will perceive that the death rate is exactly doubled; and if, in pursuing the inquiry still further, we ask what has been the mean duration of adult life among those who have passed away from us, we shall find that every man who dies in this city has been robbed of from 10 to 12 years of his existence." It must be remembered, however, that this excessive mortality falls mainly upon the lowest classes, and does not materially affect those who are likely to present themselves for life assurance.

There are some country districts, as those of a marshy and malarious character, which exhibit peculiar risks. "Taking the range of 10 years," says the Registrar-General, "the average mortality of the population in England does not exceed 17 in 1,000. The marshes in low ill-drained districts raise the mortality above this. Thus, in Ely, Whittlesey, Wisbeach, and North Witchford, four thinly-peopled marshy districts in Cambridgeshire, round the Wash, the mortality was at the rate of 23, 25, 25, and 27 in 1,000. The districts on the lower portion of the Thames suffer much from marsh diseases. All our dockyards, except Pembroke, are on unhealthy sites." The author has been informed, upon very credible authority, that in the marshy districts of Essex, near to London—viz., about Barking, Purfleet, Grays, &c.—severe agues are common, affecting the entire population, and exhibiting their consequences in severe abdominal disorders, especially enlarged spleen, in general impairment of the constitution and health, and considerably diminished longevity.

It is usually made a condition with the party proposing, that change of residence to any foreign country should not be made without acquainting the Office with the circumstance. Some of our colonial possessions—as Canada, the Cape, and New Zealand,—are quite as healthy as the mother country. Statistics are yet wanting to determine the sanitary position of Australia; but some portions of this vast country would appear, at certain seasons, to be ravaged by dysentery and fevers. Residence in the East or West Indies is a serious matter, and involves a considerable addition to a life in other respects of first-class character. An individual who purposes to make a prolonged sojourn in tropical countries should be of unexceptionable habits, and exhibit a perfectly sound state of health, and especially of the abdominal viscera;

otherwise, his life should be declined. The mortality amongst officers and civilians in India, owing to the destructive effects of fevers, dysentery, liver affections, and cholera, would appear to be nearly three times as great as among the same classes at home. In reference to habits, Colonel Sykes remarks, that where one teetotaller is cut off in India, four intemperate men lose their lives. The relative unhealthiness of other foreign stations was noticed when speaking of the occupation of the soldier.

Family History.—In consequence of the absolute influence of inheritance as a predisposing cause of certain diseases, family history occupies a prominent position in the medical estimate of life. It should be fully elicited by questions as to the age and health of parents, if living, or their ages at, and causes of, their death; also, as to the ages at and causes of death of any brothers or sisters who may have died, and the ages and health of survivors. Special inquiries should, moreover, be made, as to the existence of consumption or insanity in either the direct or collateral branches. Parties proposing for life assurance are aware that an unfavourable family history tells against a life, and, consequently, at times cover the existence of consumption by describing it under some other name. Thus, a brother or a father is said to have died of asthma or bronchitis, when, on inquiry, the disease is found to have been undoubtedly phthisis; and the very convenient expression, “died at” or “soon after childbirth,” is constantly used, not necessarily designedly, where the death has been from some constitutional malady—dying “in childbirth” meaning, very often, some weeks; and “soon after,” many months subsequently to that event. It is obvious, therefore, that not a little tact and patience, and sacrifice of time, on the part of the medical referee, are occasionally necessary in order to arrive at the truth.

The Registrar-General's Office now presents a ready means of verifying the cause of death, but which has not hitherto been systematically turned to account in inquiries connected with life assurance. In doubtful cases, one of two things may be done—either to require the party proposing to bring certified copies of the Registrar's returns, or to apply to the chief office on the part of the Company.

It is not so much any special disease that is transmitted as an inheritance, as a special type of constitution with the liabilities which it involves. The line of this hereditary transmission is not always direct from parent to offspring, but is, at times, very capricious—now passing over one generation and showing itself

in the next, now limiting itself either to the males or to the females of a family.

Sometimes inheritance does not show itself in any morbid form, but in a general debility of constitution, with diminished duration of life. Finlaison has shown statistically that there is, in certain families, a characteristic longevity, while in others there is an habitual falling short of the allotted average duration of life. "To be born of healthy and strong parents," says Lévy, "is to have a good chance of longevity; the energy of the constitution is the best buckler against the assault of destructive causes. Rush did not know an octogenarian whose family did not offer many examples of advanced old age. This observation, made also by Sinclair, has acquired the force of an axiom, so common is it to meet with longevity as a frequent occurrence among many members of the same family. Inheritance exercises the same influence on the total duration of life of short period: in the Turgot family, scarcely a member passed the fiftieth year; he who rendered it illustrious died at the age of 53, in spite of the appearance of great vigour of temperament."

The prominent position which consumption occupies in the mortality tables of this country is due far more to its undoubted and constant hereditary transmission, than to any peculiarities of climate. It is evident, consequently, that the marked existence of this disease, in any family, gravely affects the value of life of the survivors. To non-professional men it seems a hard matter to decline a life, otherwise of first-class character, simply because strumous disease has carried off certain relatives of the present or past generation. It is, nevertheless, a sound principle of action in life assurance; and the medical advisers of Offices now make it a pretty general rule to recommend the rejection of a life when so many as two immediate relatives have died of consumption. "But, nevertheless," observes Dr. Christison, "there are personal circumstances which so far outweigh this objection as to allow of a moderate risk being accepted. These are—1. The proposer's own general health, and freedom from colds in particular. 2. A robust frame. 3. A well-formed chest; not flat, or narrow, or high-shouldered. 4. Absence of the scrofulous character of the countenance. 5. A deep respiration. 6. Resemblance to the healthy side of his house, when consumption has come into the family by one side only. 7. A sound state of lungs, established by a careful stethoscopic examination. 8. His age being beyond the period when consumption is most apt to be developed in those constitu-

tionally predisposed to it." To such qualifying conditions may be added—the being beyond the age, by some years, at which consumption has generally shown itself in his family; absence of the scrofulous taint in his surviving immediate relatives; following an occupation not likely to act as exciting cause; and being of temperate habits.

It must be borne in mind that the existence of the strumous diathesis is shown not only by pulmonary phthisis, but also by diseased joints, curvature of the spine, certain eruptions, as lepra and psoriasis, glandular swellings, &c. The physician just quoted notices the frequent association of consumption and cancer in families, not in individuals, and considers that one death from each of these, in a proposer's family, places his life upon the same footing as two deaths from consumption. Insanity is, also, not unfrequently associated with either of the blood diseases in question.

Heart diseases are frequently hereditary, but their connection with acute rheumatism may explain this. Cancer is another malady hereditarily transmitted, and to which somewhat similar rules may be applied as in consumption. The age at which it is likely to develop itself, the symptoms which would indicate implication of any special organ, and the characteristic aspect, will not be lost sight of.

Articular rheumatism, again, is, in many instances, an inheritance. Of 165 cases of acute arthro-rheumatism, collected by Chomel, Patouillet, and Piorry, 81 were proved hereditary. Inheritance, again, is not only the most frequent predisposing cause of gout, but is, in many cases, the exciting cause also, where the habits of individuals, as regards exercise and temperance, are unexceptionable. Sir C. Scudamore found, that of 522 patients, 322 could trace the disease to either parent or grandparent, uncle or aunt.

The liability to certain abdominal affections, and especially to diseases of the liver, would appear to be hereditarily transmitted. M. Lévy gives the following illustration:—Louis Pierre Desmorètes died, in 1804, of abscess of the liver; of six children whom he left, one perished in the Moscow retreat, and the five others died, like their father, of abscess of the liver, between the ages of 48 and 55. The eldest of the five children, who died at Tours in 1830, left a son, now (1850) 48 years old, and of pronounced bilious temperament. This last is himself father of two sons, the elder of whom presents all the marks of hepatic predominance,

whilst the younger, who furnished these details, is of sanguine-lymphatic temperament.

Calculi and worms would also appear to be hereditary. Many cerebral affections, as apoplexy, epilepsy, and insanity, are distinctly hereditary. Cerebral hæmorrhage occurs, in certain families, generation after generation. Apoplexy, as a general rule, shows a preference for those descended from apoplectic parents, especially where the conformation is the same—or, rather, it is this, with its liabilities, which is inherited. Individuals descended from apoplectic parents, and of apoplectic aspect, should be closely questioned as to their liability to headache, vertigo, epistaxis, &c. Epilepsy has been shown, by a considerable accumulation of facts, to be hereditary.

Insanity, or the special type of constitution which involves it, is not only inherited, but shows itself in the same form in the members of the same family. The attack frequently, too, occurs at the same time of life in the offspring as in the parent. M. Foville regards hereditary transmission as the most frequent cause of insanity. M. Esquirol, in 431 insane persons, noticed hereditary transmission 337 times; and M. Desportes, in 3,458, 342 times; whilst it was noticed 105 times in 789 insane persons at the Salpêtrière.

The various risks attending this malady must be obvious to any medical man. When an individual descended from an insane parent or parents, or with one or two of his immediate relatives so affected, is described as having had an attack of “nervous depression,” “nervous debility,” “hypochondriasis,” “cerebral congestion,” or as being liable to frequent headaches, &c., it will be advisable to decline the life.

In some cases it may be desirable to extend family history inquiries to the children of the party proposing, inasmuch as, at times, especially in such blood diseases as struma and syphilis, the condition of the offspring reflects light upon the constitution of the parent.

The medical referee will be alive to the importance of viewing a faulty family history in connection with other circumstances—as, for instance, occupation. Thus, a stone-mason or baker, who has lost one immediate relative from consumption, is much in the same position as a man who has lost two relatives from such cause, but is pursuing a healthy occupation.

Previous illnesses or accidents.—Inquiry is next to be made into the antecedents of the party proposing, as regards illness and

accident. It is advisable and usual to note down the ailments from which the proposer has suffered, the date of their occurrence, their duration, and the name of the medical attendant at the time, for further information, if requisite. The medical referee must take care that the diseases of the party are correctly described, as, of course, with the unscrupulous, there will be no hesitation in deceiving, if they think they can escape detection; and even those possessed of general honesty of purpose, lay the flattering unction to their souls that there is no harm in qualifying or stating but a portion of the truth.

Special inquiry is to be made as to whether the party has had certain diseases which affect more immediately the value of life. These diseases are:—

1. *Rheumatism*.—Where the party states that he has suffered from this, it should be distinctly specified whether it was of the chronic, muscular, or acute arthritic character. If the latter, it will be necessary to elicit information as to its severity and duration, and whether the heart was affected or no. In all cases where there has, at some previous period, been an attack of acute rheumatism, it will be necessary to institute an unusually careful examination of the heart, in order to determine whether there is any permanent lesion of this viscus. If there be anything abnormal as regards sounds, rhythm, or impulse, or even occasional functional derangement in the way of palpitations, the life should be unhesitatingly declined. Medical men are now thoroughly aware of the intimate connection between acute rheumatism and diseases of the heart. Bouillaud considers that heart disease occurs in a large majority of cases of acute rheumatism. Dr. William Budd found, that of 43 cases of acute rheumatism, 21 had heart affection, and five of these pericarditis. Dr. Begbie, in his analysis of emerged risks of the Scottish Widows' Fund, found that of 53 deaths of diseases of the heart and large vessels, there were 13 persons who had suffered from acute rheumatism before acceptance. Dr. Christison, in his analysis of the Standard risks, does not find the proportion quite so great. The liability to the complication, it should be remembered, is greater in young people than in those of more advanced age. When the proposer exhibits the rheumatic diathesis, and has already had one or two attacks, it will be better to decline the life.

2. *Gout*.—The having suffered from an occasional attack of this disease, does not materially affect the value of any life, although the dangers of retrocedent gout, and the fact that the disease goes

on increasing in force and frequency of manifestation, and so ultimately affects the constitution, would seem to indicate some additional risk. Mr. Hannam states, that, out of 152,000 persons assured at the Equitable during a period of 21 years, at every age from 10 upwards, only 21 died of gout, and those principally of advanced ages; and he concludes, therefore, that it is very problematical whether it tends to shorten life. It must be remembered, however, that deaths from retrocedent or suppressed gout would be represented under different titles; and that, consequently, the statistics in question do not fairly represent the risk. When an individual is a great victim to gout, and has had severe attacks in the stomach, or suspicious head or chest symptoms, it will be better to decline the risk. In a gouty person who is a free liver and of sedentary habits, the risk is, of course, increased.

3. *Rupture*.—When this exists, it is necessary to ascertain, by special examination, its nature, and whether an effective truss is worn, the continuance in the use of which should be made a condition of acceptance. It will be well also to consider how far the risk of strangulation is increased by occupation. It is usual to make an addition to the premium in all cases, whether of long or of recent standing. The author of *Memoranda for Effecting Life Assurance* shows, that the danger from hernia is, perhaps, over-estimated, from the fact that, of 799 cases of rupture which were admitted into the hospitals of the British army during a period of about 20 years, 10 died, being only one death in every 79·9 cases.

4. *Erysipelas* is a disease of diminished vitality, and its occurrence should be regarded with suspicion, especially in those whose occupation exposes them to intemperate habits. “Erysipelas,” says Dr. Begbie, “has proved fatal in eight instances, in the experience of the Society (Scottish Widows’ Fund), and has been associated with several internal affections which have been the cause of death, more particularly with disease of the brain and its membranes, and disorders of the liver and bowels. Considering the frequency of this association, the disposition of the disease to recur from time to time, and its origin in depraved digestion and defective assimilation, I apprehend that those who have been affected by it cannot be considered as eligible subjects of life assurance.”

5. *Spitting of blood*.—The experience of all physicians shows, that pulmonary consumption is the termination of a very large majority of cases in which there has once been hæmoptysis to any extent. Dr. Walshe considers that there is no material exception to this rule, even in the case of females, where it would appear to

have been vicarious. In some cases, where there has been slight spitting of blood, it will probably be easy to determine the source of the hæmorrhage, and to show that it did not come from the lungs; but if any doubt exist, the Society should have the benefit of it. Where there has been undoubted hæmoptysis to any extent, especially in an individual exhibiting a strumous tendency, either in himself or family, the life must be unconditionally rejected.

6. *Chest affections—asthma.*—Repeated attacks of bronchitis in old people, similar attacks, or even frequent catarrhs or colds, in individuals exhibiting any strumous tendency—also, in individuals with such tendency, an attack of pneumonia or pleurisy, especially if such attack have left behind any lesion whatever—would render the life ineligible. There would obviously be increased risk, in case of any fresh acute attack, to a lung or lungs already damaged. Asthma, when of purely spasmodic character, occurring only at distant intervals, and evidently dependent solely on an exciting cause, such as peculiar locality, severe indigestion, &c., does not materially affect the value of a life. It is necessary, however, to be certain that there is no predisposing cause of such functional derangement in the shape of organic lesion of the heart or lungs.

Mr. Christie's analysis of the Registrar-General's Reports for seven years, ending with 1854, gives a total of 354,536 deaths from consumption, or a proportion of 12,355 in every 100,000. According to the *Report of the Registrar-General for 1856*, 25 in 100 deaths are caused by consumption and by diseases of the respiratory organs; consumption causing one-half of these, or one-eighth of the whole, and nearly one-half of all the deaths between the ages 15 and 35. Again, from Dr. Begbie's careful analysis of the mortality which occurred among the persons assured in the Scottish Widows' Fund from 1815 to 1845, it appears that 24·7 per cent. of the whole mortality was due to diseases of the respiratory organs. Moreover, consumption is now known not to be, as was formerly supposed, peculiarly a disease of the earlier periods of life. Although the absolute mortality is greatest between 20 and 40, the relative mortality is greatest between 40 and 50, and the liability continues even beyond 60. The consideration of such facts will show how important it is that the medical referee should acquaint himself with the tendency of the party under examination to such disease, in the way of inheritance, antecedent ailments, and present health.

7. *Dropsy and renal affections.*—As a general rule, an attack of dropsy renders a life ineligible. At all events, the occurrence

of such, even some years previously, involves the necessity of very careful examination of the heart, and also, through the urine, of the kidneys. After recent scarlatina, it will be desirable to test the urine. Dropsy, it may be observed, occupies a prominent place, as a cause of death, in the Registrar-General's reports.

Tendency to attacks of gravel is bad, in those whose ancestors have been victims to calculus. An attack of diabetes would, of course, disqualify for assurance.

8. *Diseases of the liver* have already been shown to be entailed as an inheritance, and (at least, cirrhosis of the organ) to be induced by intemperance. We must look suspiciously upon parties reported to have been occasionally bilious, or to have had an attack or attacks of jaundice, especially if they are free livers, about the middle period of life, and exposed by occupation to over-indulgence in spirituous liquors.

9. *Stomach and other abdominal affections.*—Dr. Christison considers that “in the case of proposals of assurance about the commencement of old age, a liability to stomach complaints should be viewed with distrust.” He also dwells upon the frequent connexion of latent tubercle with indigestion, and considers that a liability to this should be viewed with distrust in those who exhibit any strumous tendency. Frequent diarrhoea or vomiting may, it should be remembered, depend upon some organic lesion. The presence of tape worm, with its possible train of severe nervous symptoms, is against a life. Such a life should, indeed, not be entertained, until we are satisfied by medical certificate that the worm has been removed.

10. *Fits.*—It is not always easy to determine the nature of a fit or fits, from which an individual is said to have suffered at some previous, and perhaps distant, period. When there is any doubt, it is best not to incur the hazard of recommending the life. An attack of syncope, dependent on some evident exciting cause, as gastric derangement, exhausting discharges, or severe physical or mental exhaustion, offers no objection to a life that has subsequently been in all respects good. One attack, however slight, of unquestionable apoplectic character, or of paralysis, dependent upon whatever cause, renders a life quite ineligible. Attacks of giddiness, headache, epistaxis, or cerebral congestion, or habitual costiveness, or an irregular or intermittent pulse, are fatal objections, if occurring in subjects either personally or hereditarily predisposed to apoplexy. It should also be borne in mind, that apoplexy is peculiarly a disease of advanced life. “Of the 72 deaths,” says Dr. Begbie, “recorded

by the Scottish Widows' Fund, 20 took place before 50, and 52 after that age. Of the 63 recorded by Rochoux, 17 occurred before 50, and 46 after that period of life; and, in the experience of both, nearly twice as many instances of the disease showed themselves between the ages of 60 and 70, as between 70 and 80." Apoplexy also causes greater mortality in advanced life than any other disease.

One attack of mania, or even of hypochondriasis, or mental or nervous excitement or depression, where there is hereditary tendency to insanity, would disqualify for life assurance.

11. *Open ulcers*.—In reference to these, Dr. Brinton judiciously observes, that they "will generally oblige us to decline the life in which they are at present. The elements of the increase they add to the average risk are not very difficult to imagine. They imply a drain on the constitution, which, as age advances and nutrition declines, may become a dangerous or fatal one. Their closure sometimes brings about visceral disease, by revulsion of morbid action to internal organs. They indicate in the man either a bad constitution or hurtful habits of life—often both. Lastly, while they may at any time take on increased action, so as to threaten the limb or the life, they involve no inconsiderable risk of infection with erysipelas, if, indeed, they do not form a channel for the reception of the exanthematous disorders.

12. *Accidents* which occurred at some previous period may have left behind them results unfavourable to the value of life, in the way of permanent lesion of particular organs, or impaired state of constitution. The loss or shortening of a leg, or a stiff joint, may entail inability to take sufficient exercise, and consequent ill effects.

13. *Vaccination*.—"Have you had the small-pox, or been effectually vaccinated?" is a question to be found in the forms of examination adopted by all Offices. Mr. Milne observed, many years ago, that vaccination, if pushed to the extent of exterminating small-pox, would diminish the mortality from 1 in 40, to 1 in 43·5, or nearly 9 per cent. Its importance, as a safeguard against one of the most fatal scourges of humanity, is duly appreciated by medical men, and its performance is now insisted upon by legislative enactment. Some of the public, however, doubt its efficacy as a preventive of small-pox, while others call in question the necessity of insisting upon its performance, on the ground that the disease against which it is to act as a protection, is almost exterminated. These views may, however, be at once answered, by reference to statistical facts. In a letter addressed, some months

since, to the editor of the *Times*, Mr. Marson, surgeon to the Small-Pox and Vaccination Hospital, says, that the proportion of persons who take the small-pox after vaccination to the number vaccinated is very small indeed; and of those who do take it, and have four or more cicatrices, a fatal termination does not occur oftener than once in 200 attacks. Mr. Marson's statement is based upon a careful record of all cases admitted into the Hospital during a period of 20 years.

In the *Report of the Vaccine Board for 1856*, it is shown that small-pox is yet far from being annihilated, that the mortality is quite as great as ever among those attacked, and that even the more advanced periods of life do not enjoy immunity from it.

The vaccine scars should be looked for in all cases where there is the slightest doubt about their existence; and when they are imperfect, faint, or not to be detected, re-vaccination should be made a condition of acceptance. Some individuals seem to have been proof against the virus, after repeated vaccinations, in early life; but this affords no argument, as physiologists are aware, against re-performance of the operation in maturity.

Present health.—Having made himself acquainted with the antecedents of the party, in the shape of habits, previous ailments, family history, &c., the medical referee must proceed to a personal examination, in order to ascertain the existing state of health, and freedom from disease and deformity. If the examinee be not in present good health—if he be suffering from severe cold or bronchial affection, from headache, indigestion, diarrhœa, &c.—it will be better to defer the examination until he has recovered.

A careful examination must be made of the chest, and note taken of any deviations from the normal condition to be detected by the eye, in the way of malformation, as undue projection of either side, the condition called pigeon-breasted, &c. The state of the lungs and heart must next be examined into by palpation, percussion, and mediate or immediate auscultation. Medical men will do well to bear in mind the fact, that normally there is, in a large majority of cases, more marked vocal resonance and fremitus over the right than over the left apex. This is, however, frequently set down in medical reports as an abnormal symptom, or the unsatisfactory statement is made, that there is a difference in the two sides.

“Is the aid of the spirometer indispensable in examination for Life Assurance?” Considering the great variation in the results arrived at by different inquirers, as to standard vital capacity and

deviations therefrom; the difficulty that there is in getting individuals to use the instrument properly; the fact that the instrument itself can only give rough indications, and should never supersede the more careful examination and more reliable results obtainable by the other methods of examination, it may fairly be concluded that its aid is not indispensable, and that the condition of the lungs may, in nearly all cases, be perfectly well determined without it. There is one condition, however, namely, that of diffused tubercle, in which auscultation and percussion would fail perhaps to reveal anything definite, but where the spirometer would announce diminished vital capacity. Even here, however, by imperfect expansion of chest, by constitutional signs, such as hurried breathing and frequent pulse, and, possibly, also by family history, we should form a tolerably accurate idea of the existing state of things.

When any morbid condition of the heart exists, or is suspected, if the characteristic sounds are not at once evident, they may be rendered so by making the party walk quickly up and down the room. The aspect and pulse will generally aid in the diagnosis of such lesion.

It is, of course, quite unnecessary to dilate upon the characteristic physical signs of various pulmonary and cardiac affections, as every well-educated and experienced medical practitioner is presumed to possess a ready familiarity with them.

The circulation, and its index, the pulse, of an individual under examination is usually nervously excited. Allowing for this, any marked deviation from the healthy character, in the shape of undue frequency or slowness, irregularity, intermission, or deficiency, will not escape notice. Extreme frequency, in a party exhibiting hereditary or personal strumous tendency, is, of course, an objectionable symptom. An intermitting, or irregular pulse, if of recent standing, is against the acceptance of the life, especially in people advanced in years. Such a state of pulse may be habitual—a personal peculiarity. A report from the private medical attendant will usually decide this. Ossification of arteries, with the increased liability to cerebral hæmorrhage which it entails, will necessarily involve rejection of the life.

The state of the liver and spleen, the general softness, or otherwise, of the abdomen, may next be determined by palpation and percussion. No special examination of the kidneys through the urine is required, except in cases already indicated. When any one organ has exhibited greater susceptibility to disorder than the

others, or the party has suffered from an attack likely to involve damage of any organ, a more special and detailed report upon the present state of such will be desirable. Thus, special notice of the lungs is requisite in one who has had an attack of pneumonia, or repeated attacks of bronchitis; of the heart, in an individual who has suffered from acute rheumatism; of the liver, in any one who has been jaundiced, or frequently bilious.

Much that relates to present health has been noticed under previous heads. It remains, therefore, only to observe, that the greatest tact and delicacy should be exhibited in conducting the personal examination. The medical referee should proceed with his inquiries and investigation in a quiet, easy, and assuring manner, and thus endeavour to allay the fears and nervousness so frequently exhibited by the examinee at the commencement of the interview.

Peculiarities affecting the female.—It is necessary to make inquiries as to the regularity of the uterine functions. The hazards attending puberty and the cessation of the menses must be borne in mind, though there can be no doubt that these have been much overrated.

The danger attending childbirth would also appear to have been hitherto considered greater than it really is. The Registrar-General finds that, on an average of eight years, about 1 in every 189 accouchements were fatal. It appears also, from tables based upon Swedish returns, and cited by the same authority, that the danger of dying in childbirth is greater at the age 15 to 25, than it is at 25 to 35. "It is in this early age that a large number of children are borne by their mothers; and these first births are, for various reasons, attended with peculiar hazards." The first births that occur after 30 are, however, undoubtedly attended with relatively greater risk than those occurring at an earlier period. "It may be probably assumed," says Dr. Farr, "that the child-bearing women of a population are, in the language of the Insurance Offices, 'select lives,' at least 'select' in a certain sense; but it can only be determined by further researches, whether they are less or more liable to be attacked or to die by the diseases not incidental to childbirth. It is only well known that, when they are attacked by zymotic diseases, such as cholera and small-pox, they succumb in unusually high proportions."

An inquiry should be made of the party as to the number and favourable nature, or otherwise, of her confinements; and if she be now pregnant with her first child, or her previous confinements

have been attended with any peculiar risk, especially that of hæmorrhage, it will be better to defer the consideration of the proposal until the confinement is over. A young female who exhibits any marked contraction of pelvis, or other feature of development likely to involve undue risk from childbearing is, of course, a bad life.

Having furnished himself with all the materials necessary to form an estimate of the life before him, the medical referee will express his opinion of its eligibility for assurance, either in some general summary, or by placing it in one of a certain number of classes. These are generally three in number: the first consists of unexceptionable lives, or lives presenting so little that is objectionable that they may be assured at the usual rate; the second, of lives in which the objectionable circumstances are such as to involve more than ordinary risk, which is to be met by an addition to the premium; the third, of lives presenting objections of so serious a nature that it would be inexpedient to entertain them upon any terms.

The medical referee will save much trouble at the head office of the Society for which he may be acting, by giving due attention to all the questions in the printed form, by avoiding, as far as possible, qualified expressions, and by reporting positively upon the different points of the life before him.

In deciding in which class any given life shall be placed, all the circumstances which affect its value must be taken into consideration; and there must be borne in mind, what experience will confirm, that, as a rule, small additions are useless; and that extra risk is to be avoided by rejection, or met by a considerable addition to the premium. There will be no difficulty in at once coming to the conclusion that certain lives are eligible, and that others are quite ineligible; but there is a large number of intermediate lives that will tax the patience, demand mature consideration, and involve further inquiries before they can be finally disposed of. These, no especial rules can exactly meet; and, after all that has been advanced in the way of guidance, much must be left to the tact, judgment, and experience of the medical examiner.

NOTES AND QUERIES.

Population of Victoria.—The following return, with which we have been favoured by Mr. William Henry Archer, the Registrar-General of Victoria, may be useful to some of our readers, and will be interesting to all:—

Return showing the Population of Victoria on the 31st December, 1858.

	Males.	Females.	Persons.
Population on 30th September, 1858, exclusive of Chinese immigration <i>viâ</i> New South Wales	308,983	176,786	485,769
Increase by excess of immigration over emigration (by sea) during the quarter ending 31st December, 1858	1,530	2,116	3,646
Increase by excess of births over deaths during the quarter ending 31st December, 1858	1,396	1,829	3,225
Increase by Chinese <i>viâ</i> New South Wales during the year	11,538	..	11,538
Totals	323,447	180,731	504,178
Increase during the year	35,726	21,534	57,260

NOTE.—A Chinese protector at Belvoir was appointed on the 19th July, 1858, on account of the great influx of Chinese which had previously taken place; and the immigration from that period to the 31st December amounted to 6,538. The excess of arrivals over departures across the border during the previous six months has been estimated at 5,000.—*Melbourne, Registrar-General's Office, 20th April, 1859.*

First Course of Lectures by the Tooke Professor of Economic Science and Statistics, in King's College, London.—The measures already noticed in former numbers of this Journal* for the raising a memorial to the late Thomas Tooke, have resulted in the foundation in King's College, London, of a "Professorship of Economic Science and Statistics," endowed for ever under suitable statutes; and in the addition to the library of the Statistical Society of a case of select works on Political Economy.

In June last, the Rev. James E. Harold Rogers, M.A., of Magdalen Hall, Oxford, was elected, out of several candidates, as the first Tooke Professor. It is a fundamental condition of the Endowment that at least twenty lectures shall be delivered every year, and that at least ten of these lectures shall be delivered in the evening, so as to allow of the attendance of young men and others engaged in business or other pursuits during the day.

Mr. Rogers' first course of lectures will commence at King's College, Strand, on Monday, 23rd June, 1860, at 7 p.m. The whole of this course

* *Journal of the Statistical Society.*

will be delivered in the evening, on dates to be hereafter stated.* The following is the programme:—

1. Introductory.
2. The Revenue: its sources and kinds.
3. The Revenue of the Norman and earliest Plantagenet Kings.
4. The history of Parliamentary Control till the Revolution of 1688.
5. The Resources and Difficulties of the State in the reign of William III.
6. The Revenue till the accession of George III.
7. The American War.
8. England from 1782 till 1792.
9. The National Debt till the close of the American War.
10. The Suspension of Cash Payments.
11. The Fiscal Policy of Parliament during the War with France, 1792-1815.
12. The relations between Banking and Trading Companies, and the control of Government.
13. The Petition of the London Merchants.
14. The Fiscal Policy of Parliament from 1815 till the Abolition of the Corn Laws.
15. Protection, Bounties, and Reciprocity.
16. The charges of the Debt.
17. The operation of Excise and Customs' Duties.
18. Theories of Direct Taxation.
19. Probable effect of Gold Discoveries on Funded Debts and Fiscal needs.
20. Relation of Population, Civilisation, and Education to industrial power and financial necessities.
21. Comparison of the English Revenue and Expenditure with that of France, Austria, Prussia, Spain, Russia, and the United States.

Mortality in Mines.—The only safe basis for calculations of future probabilities is the experience of the past. No preparation for future events, no caution against possible contingencies, is of any avail unless it is educated by the history of events of the same kind which have previously occurred under somewhat similar circumstances. But the lesson of experience requires a diligent student, who will analyse the conditions under which events occur, and carefully note the variations in the causes and consequents. How melancholy appears the history of the attempts which have been made by the working classes to found institutions upon an imperfect acquaintance with the data of sickness and mortality, when we know that more than two thousand of such societies have broken up, become insolvent, and have left their members without the protection they were intended to form at the very period when the infirmities of age were increasing and help was most urgently required! Founded upon suppositions or arbitrary assumptions, or upon the experience of only a few years of life, the village club or sick box has been an instrument which, although designed in pure philanthropy, has in practice plundered the younger members for the benefit of the old, till those who perhaps were the

* A full Prospectus of the Evening Classes and Lectures at King's College, may be obtained by application to the Secretary, at the Offices of the College, Somerset House.

founders of the society have themselves become aged, but only live to see the society to which they have contributed, and for which they have laboured, hopelessly bankrupt in funds, and forsaken by the junior members, at the period when their savings, if they had been accumulated in a society founded upon true data, would have sheltered their decrepitude. The bitter and terrible experience has usually come to those who could not protect themselves against the consequences of their ignorance. Yet the lesson has not been entirely in vain; the more intelligent and educated of the producing classes are coming to understand that the liabilities of sick clubs and burial clubs increase each year, and that either the average charges upon each member must increase each year to pay the cost of the increasing risk of the sickness or death of himself, or that there must be a very large accumulation of funds during the earlier years of the society which must remain undivided, and must be improved at interest to meet the inevitable increase of sickness and death which will accrue when the younger members grow old.

In the district in which we write, the "annual life boxes" are constructed upon a plan which ignores the natural law of mortality, and seems to take for granted that the present members will never grow old. The expenses of the year being met by the contributions, the funds which ought to be put aside to meet future liabilities are divided amongst the members. From time to time, as some of the subscribers become old and sickly, the box is "reformed," or, in other words, the society is reconstituted, so as to exclude the unfortunate invalid. The parties to this injustice never appear to think that the same fate may come to them hereafter when they grow old. We can quote the testimony of a dozen reliable witnesses to prove that a very large proportion of our aged paupers have been members of ill-constructed sick clubs or life boxes, which, after receiving their savings during many years, have left them utterly without provision when sickness—against the consequences of which they had intended to provide—took them.

Meantime, nevertheless, other societies, like the Odd Fellows', have grown up upon a large scale, and have absorbed into their ranks those who were sufficiently educated to perceive the dangers of the plan which had hitherto been pursued. The difficulties which beset the subject were considered—eminent actuaries were consulted—the facts supplied by experience were closely studied; and, after a terrible conflict between prejudice and science, and a struggle, which shook the "Order" to its foundation—tables were constructed, in which the law of sickness was at length expressed with accuracy, which subsequent observations have tested.

Among the persons employed in mining, something more was required than the provision which could be made by the Friendly Societies, and something different from that which an ordinary Life Assurance Company could provide. The pitman is sometimes disabled for life—but is oftener killed. In the former case, he is prevented earning his livelihood in future, and is himself liable to the severest form of destitution; in the latter case, there are too often children and a widow left totally without provision. The problem has been, how to make an arrangement based upon the irrefragable evidence of past experience to meet the necessities of both these cases. The Miners' Provident Association is an effort to do this. We publish to-day a series of tables which have been prepared for that Society, and which are based upon a careful collection of all the facts which are

known to exist, so far as they are believed to have any relation to the matter. It must be remembered that, for the sake of simplicity, a uniform rate of contribution was deemed necessary at all ages, except those below 18 or 21, and the difficulties in the case of casualties are not so great as those which beset the actuary in calculations where the liabilities increase from youth to age. We earnestly entreat the employers and employed carefully to study these tables, and to consider whether it is not possible to find therein some basis for mutual co-operation.

The following, it will be seen, are the tables of the rate of mortality among the whole people compared with that of miners only. They show that while there is an excessive mortality among pitmen compared with other persons, that excess is more than accounted for by the deaths from casualties, and, consequently, that the class of miners actually experience less mortality from what are termed natural causes than other classes. To condense the tables within the limits of our space, the averages of quinquennial periods have been taken, though the tables from which these have been extracted have been calculated for every year in many of the columns. As, moreover, special rates have been suggested for persons under 18 years, some of the figures for the earlier years have not been collected except on points immediately referring to those rates. The excessive mortality among youths employed in coal-pits has been before referred to, and the figures subjoined exhibit its frightful extent. The inferences from the facts and the calculations are published in the hope that they may be scrutinised to the utmost. The most important part of the calculations have been submitted to two members of the Society of Actuaries, from whom suggestions of value have been received. (*See Table, p. 348.*)

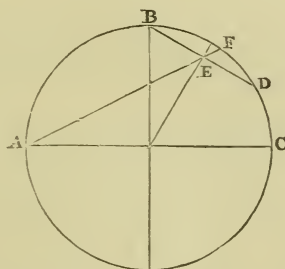
In further explanation of these tables, it is necessary to state that the Association for which they were prepared purpose to invest £120 for the widow or family of a miner killed by accident, so as to provide her, during six, eight, or ten years after the casualty, with a weekly stipend, enough "to keep the wolf from the door." It is also proposed to invest on behalf of pitmen permanently disabled by accident a certain sum, to secure an annuity for the rest of life. The sums proposed for investment have been £200, £300, and £400. The amount of annuity purchaseable at each age by this sum is indicated approximately, but is rather in excess, owing to the fact that there are a greater proportion of miners living at an advanced age than the ordinary population. It will be seen that the annuity purchaseable for £300 will provide scarcely more than five shillings a week for a man permanently disabled, between 20 and 30 years of age. The cost per member per annum for each allowance set forth in the table is ascertained by calculating the number of deaths, and the number of disablements that would occur to any large number of men (say 10,000), and dividing the total cost among the total number of members. Thus, if there were 10,000 members at the age of from 10 to 15, there would be a certain loss arising from them if they paid any less contribution than that set down in the table, if the benefits afforded to the members at other ages were granted to them.—*Newcastle Daily Chronicle.*

Age.	Annual Mortality of whole Population, averaged for Five Years, per cent.	Annual Mortality of Miners, average of Five Years, per cent.	Excess of Miners over ordinary Mortality, per cent, average Five Years.	Annual Deaths from Accidents in Mines, per cent. of employed.	Proportion of Killed, at each Age, in 100 Deaths.	Total Number Killed at each Age.	Total at each Age, of Colliers employed (by Census of 1851).	Percentage of Colliers employed at each Age.	Cost of £120 at Death, and £200 to Maimed, per Member, annually.	Cost of £120 at Death, and £300 to Maimed, per Member, annually.	Cost of £120 at Death, and £400 to Maimed, per Member, annually.	Value which £300 will purchase, as an Annuity at each Age (approximate).	Value which £400 will purchase as an Annuity at each Age (approximate).
10-15	..	..	..	·6521	22	165·0	25,300	11·5	£ s. d. 0 18 11 $\frac{3}{4}$	£ s. d. 1 0 6 $\frac{1}{2}$	£ s. d. 1 2 2	£ s. d. ..	£ s. d. ..
15-20	..	1·0325	..	·3533	17	127·5	36,080	16·4	0 10 3	0 11 4	0 12 0	..	..
20-25	·6927	1·0182	·3255	·3382	25	187·5	66,000	30·0	0 9 9 $\frac{3}{4}$	0 10 7 $\frac{3}{4}$	0 13 6	13 0 0	18 9 4
25-30	·7978	·9288	·1310	·2994					0 8 8 $\frac{1}{4}$	0 9 5 $\frac{1}{4}$	0 10 2	13 4 9	18 19 8
30-35	·8617	·8639	·0072	·2897	17	127·5	43,560	19·8	0 8 5	0 9 1 $\frac{1}{2}$	0 9 10 $\frac{1}{4}$	15 4 0	20 5 4
35-40	·9418	1·0135	·0717	·2907					0 8 5 $\frac{1}{4}$	0 9 1 $\frac{3}{4}$	0 9 10 $\frac{3}{4}$	16 4 9	21 13 0
40-45	1·1645	1·4308	·2663	·3029	11	82·5	26,180	11·9	0 8 6 $\frac{1}{2}$	0 9 6 $\frac{1}{4}$	0 10 3 $\frac{1}{2}$	17 10 9	23 7 8
45-50	1·4663	1·9839	·5176	·3151					0 9 1 $\frac{1}{2}$	0 9 11 $\frac{1}{4}$	0 10 8 $\frac{1}{2}$	19 4 9	25 13 0
50-55	2·0394	2·6419	·6025	·3469	7	52·5	13,860	6·3	0 10 0 $\frac{3}{4}$	0 10 11 $\frac{1}{4}$	0 11 9 $\frac{3}{4}$	22 10 0	28 13 4
55-60	2·7884	3·2686	·4802	·3787					0 11 0	0 11 11 $\frac{1}{4}$	0 12 10 $\frac{1}{2}$	24 14 0	32 18 8
60-65	4·2731	4·6626	·3895	·6805	1	7·5	9,020	4·1	0 19 9	1 1 5 $\frac{1}{2}$	1 3 1 $\frac{1}{2}$	28 9 6	38 12 8
65-70	6·2153	8·1820	1·9667	·8314					1 4 1 $\frac{1}{4}$	1 6 2 $\frac{1}{2}$	1 8 3 $\frac{1}{4}$	34 13 9	46 5 0
						750·	220,000						

NOTICES OF NEW WORKS.

Popular Tables arranged in a new Form, giving Information at Sight for ascertaining, according to the Carlisle Table of Mortality, the Value of Lifehold, Leasehold, and Church Property, Renewal Fines, &c., the Public Funds, Annual Average Price and Interest on Consols from 1731 to 1858; also various interesting and useful Tables, equally adapted to the Office and the Library Table. By CHARLES M. WILlich, Actuary and Secretary to the University Life Assurance Society. Fourth edition. London: Longman, Brown, Green, and Longmans; 1859.

WE have already called attention to former editions of this publication.* It has now, as will be seen, reached a fourth edition; and, considering the variety and utility of the information which it contains, we cannot say that we are surprised at it—notwithstanding the fact that comparatively few persons are very conversant with such matters as are herein treated of. The title explains so fully the nature of the contents that it is hardly necessary for us to further specify them; but there are one or two particulars not referred to in the title which are, from our point of view, of great interest, and to which we shall therefore beg leave to direct the attention of our readers. The first is the table at page 92, exhibiting the alterations in the Bank of England discounts. These alterations are given side by side with the price of consols, the amount of bullion, and that of the circulation; and notes are added of the occurrence of the great events which most materially affect these quantities. The reader is accordingly enabled to see at a glance how a change in any one of them operates as regards the others, and has thus very useful materials for forming an opinion as to their mutual relationship. The other particular we shall notice is the ingenious method given by the author of approximating to the quadrature of the circle. In his own words, it is as follows, and is, we think, quite worthy of record in these pages:—



“ Let AB be a quadrant of a circle ABC . In the arc BC , place a chord BD , equal to the radius, so that the arc BD is one of 60° . Bisect BD in E ; join AE , and produce the joining line to meet the circumference in F . Then AF differs from the side of a square equal in area to the circle by somewhat more than the one four-thousandth part of that side.

* See vol. iii., page 341.

“The amount of error, which is about the $\frac{1}{3747}$ part of the side of the square, may be thus shown:—

Let the radius = 1. Then $xy = (1 + \cos 30^\circ)(1 - \cos 30^\circ) = \frac{1}{4}$.

The line A E = x .

„ E F = y .

„ A F = $x + y$.

$$x^2 = 1 + \cos^2 30^\circ + \cos 30^\circ = 1 + \frac{3}{4} + \frac{\sqrt{3}}{2} = \frac{7 + 2\sqrt{3}}{4}.$$

$$\therefore x = \frac{1}{2}\sqrt{7 + 2\sqrt{3}} = 1.6174131827, \text{ \&c.}$$

$$y = \frac{1}{4x} = \frac{1}{2\sqrt{7 + 2\sqrt{3}}} = .1545678016, \text{ \&c.}$$

$$\begin{aligned} x + y &= \frac{1}{2} \left\{ \sqrt{7 + 2\sqrt{3}} + \frac{1}{\sqrt{7 + 2\sqrt{3}}} \right\} = \frac{1}{2} \frac{8 + 2\sqrt{3}}{\sqrt{7 + 2\sqrt{3}}} = \\ &= \frac{4 + \sqrt{3}}{\sqrt{7 + 2\sqrt{3}}} = 1.7719809844, \text{ \&c.} \end{aligned}$$

But when the diameter is 2, the area is 3.141592653,

\&c., and the square root is 1.77245385, \&c.

which is the side of a square equal to the area of the circle.

According to the diagram, the line A F is the side of

a square, by calculation found to be 1.77198098, \&c.

The difference between the sides of the squares is00047287, \&c.

So that the side determined by this simple geometrical construction differs in defect from the truth by only $\frac{1}{3747}$ of itself.”

This approximation was thought worthy of notice by the Royal Society, and was communicated to that learned body by Professor Stokes. It seems to us that, from its simplicity and proximate accuracy, it must be of considerable use in practical mechanics and engineering. Altogether, the book comprises a vast amount of useful information, and a very ample index affords the means of getting at it with great readiness.

Theory of Compound Interest and Annuities, with Logarithmic Tables.

By FEDOR THOMAN, of the Société Crédit Mobilier of Paris. London: Lockwood & Co.; 1859.

THIS little work, apparently written in our language originally by a foreigner, is edited anonymously by an Englishman, as it would seem. It contains, in a compact form and very neat type, the information usually found in works on the subject, and has some original tables for finding the values of annuities when the interest and annuity are not paid within the same intervals of time. The author is evidently well acquainted with the theory of his subject, and from his position has had ample means of studying it practically. He has dedicated his book to the Prince de Joinville.

CORRESPONDENCE.

THE LEIPZIEGER KRANKENCASSE.

To the Editor of the Assurance Magazine.

SIR,—I hope it will be of some interest to you, and to the readers of the *Magazine*, if I give you some account of a Company, proving the brilliant success of the adoption of scientific principles in carrying out assurance business. It was in 1855, when Dr. Heym, in Leipzig—a mathematician who has well studied life contingencies under all their different points of view—formed the idea of promoting a Society for the purpose of insuring a weekly sick allowance to its members. Naturally enough for him, he meant to establish a Society on sound, rational, and scientific principles; but, to the public, his ideas appeared to emanate from quite a new point of view, and where dared he hope to find belief in the correctness of his statements and calculations? Up to that time, and still, there is in Germany a vast number of Societies which promise to provide for their members in case of sickness, but they are all on the principles of your old Friendly Societies—they admit members of all ages at a uniform rate of premium; and, in general, this premium would not even be sufficient for young ages. It is no wonder that these Societies are constantly breaking up, just as it has been in England; and we often see that those members who have paid premiums for many years find themselves without the support of the Society, which has become insolvent when they looked forward for its assistance. Dr. Heym began his work by publishing a paper about the organization of Friendly Societies (*Die Einrichtung der Krankencasse*), with special reference to Leipzig. It was the principal object of Dr. Heym to show in this paper the deficiencies of the old system, and to demonstrate in a clear and popular way how a Friendly Society ought to be organized, what premiums should be taken, and what part of them should be regularly reserved in order to render it safe. Dr. Heym found it not easy to fix the data upon which the premiums might be computed. Statistics with reference to sickness had been less cultivated in Germany than you might expect; and Dr. H. himself had to collect data from the books of some Friendly Societies in Leipzig. By these means he found that the duration of sickness, at the average age of 45 years, has been in Leipzig 1·2784 weeks per annum, while it is in England (according to Finlaison's report) 1·4724 weeks; and, reduced in this proportion, 0·86888 : 1, he makes use of the English data to fix the mean duration of sickness for Leipzig.

It had been a general rule, in the old Friendly Societies in Germany, to pay the whole sick allowance only for the duration of six months, then to reduce it to one-half for another six months; then, if the sickness continued longer than a year, to reduce it still more, and by no means to grant any sick allowance for longer than one year and a half for the same sickness. It seemed advisable not to give up this system; but, nevertheless, to allow the members to insure such diminishing sick allowance at reduced premiums. Dr. Heym found, by examining the books of the Friendly Societies then existing at Leipzig, that he could reduce the premiums for such a diminishing sick allowance by multiplying them by 0·73391.

Table of Premiums, calculated by Dr. Heym, for a Daily Sick Allowance of Unity, payable during the whole duration of Sickness—interest 3 per cent.

Age.	Annual Premium.	Single Premium.	Age.	Annual Premium.	Single Premium.
20	10.807	240.40	70	54.770	352.87
30	12.852	256.50	80	89.964	366.73
40	16.163	277.42	90	128.398	494.97
50	21.898	300.23	95	145.291	145.29
60	32.951	326.43			

This paper had a very great effect; it was approved of in all parts of Leipzig; and already, in 1855, a mutual Society, granting to its members a weekly allowance in case of sickness, has been established on rational principles. Its leading features, as contained in its deeds, are:—Insurance taken for the whole term of life, or for a short period—from 1 to 5 years. Members are admitted from 15 to 50 years of age; when older than 50 years, only under special conditions. A weekly sick allowance can be insured of from 1 thaler (3s. sterling) to 5 thalers (15s. sterling); the premiums to be calculated on the best data at 3 per cent. interest, and to be charged with 10 per cent. for expenses of management and bonus. A balance to be made up every year, and an extra premium to be charged if the account should show that the liabilities exceed the assets; in case of a considerable surplus, it is to be divided, but not until the Society has become so large that no considerable deviation from the average sickness is to be feared. Two different methods of insurance are introduced — A, the entire weekly sick allowance payable for the duration of the sickness, but not exceeding 18 months: B (1), entire allowance payable for 6 months, one-half of it for the next 6 months, and one-fifth for the then succeeding half year; (2), one-half of the allowance payable, if the sickness does not entirely prevent the member from working for the duration of 1 year, and one-fifth for the then succeeding 6 months; (3), one-half of the allowance payable if the patient is convalescent, and in the third semestre only one-fifth. For one and the same sickness, no allowance granted longer than 18 months continually. If the sickness last longer, a medical investigation is to decide whether the patient is to be considered curable, or not; if curable, he has no claim for sick allowance until he has been completely cured, and no other sickness occurs before the lapse of the year afterwards; if incurable, and he has not been a member for 20 years, the board of directors shall decide whether any further claim shall be allowed; but if he has been a member for 20 years, he is to receive annually, for the remainder of his life, such sum as his sick allowance would have amounted to in the year when he became an invalid, according to the tables of average amount of sickness. All disputes and questions between a member and the Society finally to be settled by arbitration.

From the annual reports and balance sheets of the Society I extract the following data:—

End of	Number of Persons insured.		WEEKLY SICK ALLOWANCE.		Persons falling Sick.		Days of Sickness.		Mortality.	
			Whole Term of Sickness.	Diminish- ing Rate.						
	Males.	Females.	Thalers.	Thalers.	Males.	Females.	Males.	Females.	Males.	Femls.
1855	321	176	330 $\frac{1}{6}$	539 $\frac{2}{3}$	20	8	338	132	..	..
1856	867	568	691 $\frac{1}{3}$	1,957 $\frac{1}{3}$	165	79	3,570	1,713	5	1
1857	1,386	1,064	1,040 $\frac{2}{3}$	3,768 $\frac{1}{6}$	361	240	7,621	5,501	15	6
1858	1,650	1,326	1,212 $\frac{1}{6}$	4,490	472	335	8,500	6,420	11	14

	Premiums, &c.			Interest.			Sundries.			Total Receipts.		
	Th.	gr.	pf.	Th.	gr.	pf.	Th.	gr.	pf.	Th.	gr.	pf.
1855	661	4	0	1	24	0	33	23	5	696	21	5
1856	3,098	16	8	33	23	5	5	21	0	3,138	1	3
1857	6,098	4	1	96	15	5	92	9	5	6,286	29	1
1858	8,296	17	8	203	10	3	6	10	3	8,506	8	9

	Sick Allowance paid.			Salaries, &c., Expenses of Management, Commission.			Total Expenditure.			Surplus.		
	Th.	gr.	pf.	Th.	gr.	pf.	Th.	gr.	pf.	Th.	gr.	pf.
1855	108	16	4	153	20	9	262	17	3	434	14	2
1856	1,251	10	3	525	4	8	1,776	15	1	1,361	16	2
1857	3,138	18	0	959	3	6	4,097	21	6	2,189	7	5
1858	4,176	26	6	1,152	7	1	5,329	3	7	3,177	5	2
Accumulated Funds.....										7,162	13	1

Assets.

	Present Value of Premiums.			Cash and Debtors.			Total.		
	Th.	gr.	pf.	Th.	gr.	pf.	Th.	gr.	pf.
1855	23,283	9	6	448	9	6	23,731	19	6
1856	68,372	3	0	1,796	0	4	70,168	3	4
1857	116,213	7	2	4,054	18	9	120,258	26	1
1858	142,655	16	5	7,189	1	1	149,844	17	6

Liabilities.

	Present Value of Sick Allowance.			Creditors.			Total.			Surplus Fund.		
	Th.	gr.	pf.	Th.	gr.	pf.	Th.	gr.	pf.	Th.	gr.	pf.
1855	23,560	26	4	13	25	4	23,574	21	8	156	27	4
1856	69,610	15	9	..	..	..	69,610	15	9	557	17	5
1857	119,345	9	6	60	11	0	119,405	20	6	853	5	5
1858	148,263	5	7	26	18	0	148,289	23	7	1,554	23	9

I consider these figures very instructive, and they scarcely want any further explanation. They clearly show how quickly a well-organized Friendly Society is gaining the confidence of the public, although it be the first institution of this kind which has broken through the customary organization of former times; and, at the same time, they prove the high degree of security existing in the *scientific* foundation of an Insurance Office.

After such results, we cannot be astonished in learning that the conductors of this Society wished to extend its operations beyond the narrow sphere of the town of Leipzig (with 80,000 inhabitants) and its vicinity, to which its activity had been limited. It is again Dr. Heym, whom we may consider as the soul of the institution, who works out the new plan of the Society to be adopted, embracing life assurance and annuities in case of ill health, while continuing the insurance of sick allowance, and with the intention to extend its activity to Saxony first, and then to Germany in general.

But, before I report this new plan, I must not forget to mention another paper of Dr. Heym, published lately under the title—*Observations on the Books of the Leipzig Krankencasse.*

After a recapitulation of the data upon which the premiums have been calculated, and a statement of the way in which the data have been obtained, we find some tables of annuities, life assurances (single and annual premiums), and single and annual premiums for sick allowance, at 3, $3\frac{1}{2}$, 4, 5, and 6 per cent. interest. From these tables I quote—

Annual Premiums for providing for a Weekly Allowance of Unity in case of Sickness. Net premiums charged with 10 per cent.

AGE.	FOR THE ENTIRE DURATION OF SICKNESS.					DIMINISHING ALLOWANCE.				
	3 per Cent.	$3\frac{1}{2}$ per Cent.	4 per Cent.	5 per Cent.	6 per Cent.	3 per Cent.	$3\frac{1}{2}$ per Cent.	4 per Cent.	5 per Cent.	6 per Cent.
20	1.48	1.44	1.36	1.28	1.24	1.08	1.04	1.00	0.96	0.92
25	1.60	1.56	1.48	1.40	1.32	1.16	1.12	1.08	1.04	0.96
30	1.76	1.68	1.64	1.56	1.48	1.28	1.24	1.20	1.12	1.08
35	1.96	1.88	1.84	1.72	1.64	1.44	1.40	1.36	1.28	1.20
40	2.20	2.16	2.08	1.96	1.88	1.64	1.56	1.52	1.44	1.36
45	2.56	2.48	2.40	2.28	2.20	1.88	1.80	1.76	1.68	1.60
50	3.00	2.92	2.84	2.72	2.64	2.20	2.16	2.08	2.00	1.92

During the existence of the Society, the form of proposals has been changed very often. Medical examination has greatly increased. In 1858, 20 out of 540 proposers had to undergo a medical examination; and, in 1853, 331 out of 999 proposers. The physicians had generously renounced every fee for the examinations, nearly 1,000 in number.

Special care has been taken to avoid frauds; and it has been made a general rule never to insure a weekly sick allowance exceeding the weekly earnings of the member.

The premiums are paid monthly, they are collected from the members; this system causes a considerable part of the expenses, but it seems unavoidable. It is of interest to notice the influence of the days of the week in the beginning of sickness.

	Males.	Females.	In general.
	Per Cent.	Per Cent.	Per Cent.
Sunday	8·10	8·90	8·41
Monday	20·46	19·90	20·24
Tuesday	19·10	17·80	18·60
Wednesday	17·86	13·92	17·84
Thursday	12·98	17·80	13·35
Friday	10·49	9·38	10·06
Saturday	11·01	12·30	11·50
	100·	100·	100·

According to Dr. Heym, these results are easily accounted for; there exists such a powerful inclination towards amusements (which in Germany, you know, principally take place on Sunday), that a slight uneasiness is overlooked, and not notified to the Society till Monday; on the other hand, the Sunday pleasures, which often are sought for when the body is already unhealthy and ought to repose, are enemies to health, and cause a great deal of slight, and often serious, uneasiness. Thus, the number of persons falling sick increases in the beginning of the week, and principally on Mondays.

Particulars are given as to the book-keeping, and the interior working of the Society; and they prove a high degree of order, regularity, and circumspection.

The general meeting, of the 25th of June, unanimously voted that the operations of the Society should be extended, as I have already mentioned, to different branches of insurance, and to a larger circle than before. The board of directors, and a special committee, are entrusted with the execution of this resolution, and the plan to be followed has been just published.

Each branch of insurance forms a separate mutual Society. With reference to the insurance of sick allowance, no important alterations will take place; life assurance will be limited to the single life insurance, payable at death; the smallest sum to be insured will be 10 thalers (£1. 10s.), the maximum 3,000 thalers (about £450 sterling).

The plan to insure annuities in case of ill health is quite a new one, at least in Germany, and some of its details will, I think, be of interest. The Society will insure annuities, not exceeding 300 thalers (about £45), and not under 10 thalers (£1. 10s.).

The annuity will begin, in any case, at a certain fixed age of the member (deferred annuity); but it will commence earlier when the member, either by sickness or accident (but not occasioned *sud culpa*), becomes incapable of working (incompetent); the annuity ends with the death of the member, or when the incapability for work ceases.

The insurance may be made under either of two conditions, the annuity falling due—

1. In case of permanent incapability.
2. In case of temporary incapability.

Events and accidents causing the loss of such parts, faculties, or qualities of the human body as are necessary to every description of work, are considered as constituting permanent incapability.

Serious illness, for more than a month, is considered as constituting temporary incapability.

If the invalid member is, or becomes, capable of doing some other work than that which he did before he became an invalid, the directors are to fix his annuity according to the difference in the pecuniary values of the two kinds of work. As the data referring to incapability are very scarce, the premiums are to be calculated on a hypothesis of Dr. Heym, published in the *Rundschau of Insurance*, some time ago. According to this hypothesis, the probability of a person aged 79 years becoming invalid or incapable the next year is equal to certainty—that is, equal to 1, while this probability is equal to 0·00002 at the age of 20 years, and a geometrical progression from the age 20 to 79 is formed between these extremes.

The data which Dr. Heym proposes to take, as fundamentals for the Society, are contained in the following table:—

Age.	Persons living.	Sickness of each Person.	Probability of becoming an Invalid next year.	Age.	Persons living.	Sickness of each Person.	Probability of becoming an Invalid next year.
		Days.				Days.	
20	6,415	6·7174	0·00002	58	3,838	14·3582	0·02126
21	6,368	6·5798	0·00003	59	3,716	15·7819	0·02554
22	6,321	6·5483	0·00003	60	3,588	17·1143	0·03068
23	6,274	6·4765	0·00003	61	3,453	18·4646	0·03686
24	6,228	6·4603	0·00004	62	3,315	19·5975	0·04427
25	6,182	6·4540	0·00005	63	3,169	21·0383	0·05318
26	6,134	6·5602	0·00006	64	3,017	21·9169	0·06389
27	6,085	6·7281	0·00007	65	2,858	22·8208	0·07675
28	6,035	6·8341	0·00009	66	2,692	24·1958	0·09219
29	5,985	6·9088	0·00010	67	2,523	25·8923	0·11075
30	5,933	6·9142	0·00013	68	2,351	27·3558	0·13304
31	5,881	6·9648	0·00015	69	2,178	29·9771	0·15981
32	5,826	6·9357	0·00018	70	2,003	33·2040	0·19198
33	5,770	7·1287	0·00022	71	1,829	36·3748	0·23062
34	5,713	7·2394	0·00026	72	1,651	40·2041	0·27703
35	5,655	7·5675	0·00031	73	1,477	43·2733	0·33279
36	5,595	7·6301	0·00038	74	1,308	46·2307	0·39977
37	5,536	7·7378	0·00045	75	1,145	49·4550	0·48022
38	5,476	7·7877	0·00054	76	991	52·6963	0·57687
39	5,415	7·9314	0·00065	77	849	57·0834	0·69298
40	5,354	7·9522	0·00078	78	720	61·4667	0·83245
41	5,292	8·2733	0·00094	79	604	65·0819	1·00000
42	5,229	8·4248	0·00113	80	500	66·7644	
43	5,163	8·5554	0·00136	81	407	73·0500	
44	5,096	8·7333	0·00163	82	330	78·4260	
45	5,025	8·9553	0·00196	83	262	82·2489	
46	4,952	9·0630	0·00235	84	204	86·0696	
47	4,877	9·4276	0·00283	85	155	89·8918	
48	4,801	9·8492	0·00340	86	114	93·7152	
49	4,724	10·3338	0·00408	87	82	97·5371	
50	4,643	10·7021	0·00490	88	57	101·3585	
51	4,560	11·2019	0·00589	89	38	105·1817	
52	4,473	11·6348	0·00703	90	24	109·0034	
53	4,381	11·8386	0·00850	91	15	112·8262	
54	4,283	11·9366	0·01021	92	9	116·6487	
55	4,180	12·3615	0·01227	93	5	120·4703	
56	4,070	12·8136	0·01473	94	3	124·2911	
57	3,956	13·3110	0·01770	95	1	128·1150	

Your obedient servant,

WILHELM LAZARUS.

Hamburg, 16th August, 1859.

AS TO THE AUTHORSHIP OF THE ESSAY ON THE "MEDICAL
ESTIMATE OF LIFE FOR LIFE ASSURANCE."

To the Editor of the Assurance Magazine.

SIR,—In the October number of the *Assurance Magazine*, a long extract is given from the *American Life Assurance Magazine* on the "Medical Estimate of Life for Life Assurance." Permit me to send you a copy of the *Medical Estimate of Life for Life Assurance*, by Dr. Stephen H. Ward, of 28, Finsbury Circus, E.C.—the London Medical Officer of this Association—and to point out that the article, appearing as original in your *American cotemporary* and reprinted in your *Magazine*, is a *verbatim* copy of Dr. Ward's treatise.

Had the circulation been confined to the other side of the Atlantic, no notice would have been taken of this plagiarism; but I cannot allow Dr. Ward's admirable little pamphlet to appear in your pages as an American production, without declaring its nativity, and the name of its author. There can be no doubt as to the authorship of the pamphlet, for it was published in London, in 1857, and I had the pleasure of perusing the manuscript.

Trusting that you will publish this communication in the next number of the *Assurance Magazine*, and render justice to the author of the *Medical Estimate of Life for Life Assurance*.

I am, Sir,

Your obedient servant,

THOS. FRASER.

*Life Association of Scotland Office,
20, King William Street, City, London, E.C.,
5th Nov., 1859.*

Res. Sec.

ON THE CASE RECENTLY TRIED OF "BLACK *v.* THE ENGLISH
WIDOWS' FUND LIFE ASSURANCE SOCIETY.

To the Editor of the Assurance Magazine.

SIR,—This case was tried before the Lord Chief Baron at Guildhall on Monday, December 12th, and the plaintiff was nonsuited. It is a warning to actuaries not to trust to verbal understandings and to the anticipations of individual directors as to what a Board will do; and, as such, a short report of what took place may be useful.

Mr. Black was chief clerk of the office, at £150 a year; to which was afterwards added the post of actuary, at £50 a year additional. The valuations were left to be paid for according to the judgment of the directors. Mr. Black, thinking this rather close work, applied by letter to the directors, and was answered by a resolution that no *increase of salary* would be granted. Upon this ambiguous decision, which neither creates nor rebuts any presumption as to an understanding about the valuations, to which was added some information from individual directors, Mr. Black made a complete valuation of the affairs of the office. But though the directors were placed in the witness box, they were not examined upon the proceedings of the Board, nor upon the private information given to Mr. Black.

Nothing but the actual resolution was permitted to be given in evidence, and the case thereupon broke down.

We have heard, and believe, that the valuation was perfectly good, except in one minor point, on which Mr. Black had to obey instructions with which he was furnished. Mr. Black resigned his office shortly after the valuation was made, and the directors refused to pay anything for it. The sum for which the action was brought was £75.

We cannot, of course, express any positive opinion upon a case, all the facts of which were not allowed to be brought out. That the directors had the *law* on their side is clear; but the whole case raises a suspicion that they owe a debt of honour to Mr. Black.

The Lord Chief Baron made an observation which tends to show how necessary it is to have definite understandings. He remarked that it was exceedingly common for merchants, &c., to desire their clerks to take home the ledger, &c., and do office work in the evening, upon emergencies. This remark was made upon Mr. Black's evidence that all the valuation was made out of office hours, and at his own home. But the Lord Chief Baron did not know the difference between *office work* and *valuations*. A merchant may desire his clerk to *lengthen the office day* at his own home, by continuation of his office work. That this should sometimes happen, at particularly busy periods, is made reasonable by necessity. But a merchant does not desire his clerk to undertake special business, of a kind wholly different from office routine, except for extra payment. That is to say, such is not the custom. A man may, no doubt, if he believe his clerk would rather do it than lose his place, insist upon his doing anything—learning the fiddle, for example—in his hours of rest. But this is not usual. From this, actuaries may see that the tendency of the Courts will be to consider the valuations as that sort of taking stock to which an ordinary assistant is bound to give some extra time. In fact, the Lord Chief Baron—who is especially conversant with commercial habits—asked Mr. Black if a valuation were not a kind of *taking stock*, and received an affirmative reply. This should not pass unnoticed. The merchant who counts his barrels of sugar takes stock; but he is much more nearly doing the work which belongs to an actuary when he *takes the facts* which are to guide him as to whether he will ship for the colonies or wait for the home market.*

Valuation is the highest business of the most skilful officers—taking stock is the most ordinary business of the lower grade.

It concerns the actuary to take care that his contracts are definite; and this is the moral of the case.

Yours truly,

ONE WHO EXAMINED THE VALUATION, AND WAS
IN COURT DURING THE TRIAL.

14th Dec., 1859.

* One of the principal objects which the founders of the Institute from which this *Journal* emanates had in view, was, the removal of such gross misapprehension as is here displayed by the Court.—ED. A. M.

INSTITUTE OF ACTUARIES.

ANNUAL EXAMINATIONS.

The examinations for the present year have been fairly attended. At the matriculation, five candidates have presented themselves; and, for the second and third year, four and two respectively. We hope to publish, in the next number of the *Journal*, the names of the candidates, and the order of merit. We append a few of the questions, for the consideration of future candidates:—

FIRST YEAR.

$$1. \text{ Simplify } \frac{1}{13} \cdot \frac{\frac{2}{3} + \frac{4}{7}}{\frac{3}{5} - \frac{7}{4}} - \left[\frac{3}{4} + \frac{5}{6} - 2 \left(\frac{3}{8} - \frac{1}{12} \right) \right].$$

5. Given $\log. 2 = .301030$, and $\log. 3 = .477121$; find $\log. 6$ and $\log. 24$.

12. Investigate a formula for the summation of an arithmetical series.

13. Sum the series $\frac{2}{3} + \frac{3}{5} + \left(\frac{2}{3}\right)^2 + \left(\frac{3}{5}\right)^2 + \left(\frac{2}{3}\right)^3 + \left(\frac{3}{5}\right)^3 + \dots$, &c., to infinity.

17. How many permutations can be made of the letters in the word "assurance"?

20. Find the middle term of the expansion of $(1+x)^6$.

23. How does Euclid define a straight line? Give a more satisfactory definition than his, proving the definition you enunciate by means of one of the Propositions of the First Book of Euclid.

SECOND YEAR.

1. Assuming the common series for $\log. (1+x)$, deduce a convenient practical formula for calculating logarithms.

Explain the process of calculating a table of common logarithms.

2. Prove that $\log_{10} N = \log_{10} e \cdot \log_e N$, where e is the base of the Napierian logarithms; also, that $\log_e 10 \cdot \log_{10} e = 1$.

4. A single die is thrown twice; what is the probability of the sum of the two numbers thrown being 9?

11. Out of 1,000 persons living at the age of 40, how many will survive to 60 according to De Moivre's hypothesis?

21. Prove the formula for the endowment of a life m , at the age $m+n$, with return of premiums in case of previous death.

$$\frac{D_{m+n}}{N_{m-1} + R_{m+n} + nM_{m+n} - N_{m+n-1} - R_m}.$$

25. Prove the formula for the value of an annuity $\frac{1}{p+d} - 1$, supposing the purchaser to obtain a given rate of interest, besides insuring the life to secure return of his capital.

THIRD YEAR.

2. Give a brief account of the way in which the reserve for the liability is determined in the Equitable Society.

3. State the conditions which must obtain in order that the reserve so determined shall prove sufficient, and no more than sufficient.

5. What is meant by "limited liability," as applied to Life Assurance Companies; and how does it operate in a Mutual Life Assurance Society?

11. It is desired to estimate the progress, in wealth and population, of a recently-settled district: what returns would you consider best calculated to afford information for such a purpose?

16. Supposing a general property-tax to be established, how would you recommend that it should apply to professional incomes and to incomes for life?

17. Can the Bank of England increase the circulation at pleasure; and if so, in what way?

PROCEEDINGS OF THE INSTITUTE.

Adjourned Annual General Meeting, Saturday, 15th October, 1859.

CHARLES JELlicoe, Vice-President, in the Chair.

The circular convening the meeting was read, and the minutes of the annual general meeting of the 4th June, 1859, were read and confirmed.

A special Report from the Council, and also a Report from the Auditors, were then read. From the former it appeared that the funds of the Institute amounted at the time to £452. 18s. The latter was as follows:—

"AUDITORS' REPORT.

"Gentlemen,—We beg to report that we have compared the list of Members marked A, with the counterparts of the receipts given to Members for their subscriptions, and also with the entries on the credit side of the Cash-Book, and we find that the total income of the Institute, from ordinary subscriptions, for the Session 1858-9, was £360. 3s., subject to a deduction on account of certain subscriptions not paid at the date of the balance. The list marked B gives the particulars of these subscriptions unpaid, viz., £35. 14s.

"We have also examined the vouchers for current expenses, which are all complete and in order, and we find the total amount of the expenses for last Session to have been £305. 7s. 7d.

"We beg to recommend that a Journal and Ledger be added to the Cash-Book now used, because we consider that a mere classification of cash payments affords few tests of accuracy. We further recommend, that the list of Members marked A be subject every year to revision.

"C. CHILD,	} Auditors.
J. B. HAYCRAFT,	
C. WATKINS,	

"29th August, 1859."

An abstract of receipts and payments, to the 30th June, 1859, was then read, and it was resolved unanimously—"That the special Report of the Council, together with the Report of the Auditors, and the abstract of receipts and payments, be adopted, and entered on the Minutes."

The meeting then adjourned.

First Ordinary Meeting, Session 1859-60.—Monday, 28th November, 1859.

W. B. HODGE, Vice-President, in the Chair.

The minutes of the adjourned general meeting were read and confirmed.

The Secretary announced several donations to the library.

Several candidates for election at the next meeting were nominated.

A paper was read "On the rationale of certain actuarial estimates," by Charles Jellicoe, Vice-President.

Thanks having been voted to Mr. Jellicoe, the meeting adjourned to Monday, the 2nd January, 1860.

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END OF VOL. VIII.

EAGLE INSURANCE COMPANY.

REPORT OF THE DIRECTORS FOR THE YEAR ENDING 30TH JUNE, 1859.

ANOTHER year has elapsed, and the Directors have to make their usual Report to the Proprietors. As on former occasions, they will first beg the attention of the Proprietors to the Surplus Fund Account, which serves, as they are no doubt aware, to exhibit the chief occurrences of the year, the Balance Sheet hereafter to be referred to indicating the condition of the Company at the end of it.

The first-mentioned document is as follows:—

SURPLUS FUND ACCOUNT.

INCOME OF THE YEAR ENDING JUNE 30 TH , 1859.				CHARGE OF THE YEAR.			
	£	s.	d.		£	s.	d.
Balance of Account, June 30 th , 1858	482,879	7	7	Dividend to Proprietors	10,138	7	6
Ditto, Albion Insurance Company	123,526	0	10	Claims on decease of Lives Assured	220,917	14	2
Premiums on New Assurances	24,120	12	7	Additions thereto	18,350	17	11
Ditto on Renewed	237,769	10	3	Policies surrendered	12,075	13	0
				Reassurances, New	5,308	9	2
	281,890	2	10	Ditto, Old	23,021	3	7
Interest from Investments	79,650	19	4		281,673	17	10
				Commission	9,247	4	0
	361,541	2	2	Medical Fees	912	17	0
				Income Tax	1,977	8	6
				Expenses of Management	9,982	18	7
					303,794	5	11
				Balance of Account, June 30 th , 1859, as below	659,013	17	2
	£972,946	10	7		£972,946	10	7

Examined and found to be correct,

(Signed) THOMAS ALLEN,
WILLIAM HENRY SMITH, Jun., } *Auditors.*

The Proprietors will remember that the junction of the Albion with the Eagle was completed at the commencement of the past year; and it will be seen, that out of the Assets transferred by that Company the sum of £123,526. 0s. 10d. was contributed to the Surplus Fund.

The income from Premiums on new Assurances is £24,120. 12s. 7d. A portion of the risk under these, however, it has been necessary to reinsure, and the amount paid on this score will be seen on the credit side of the account.

The total income from Premiums and interest is £361,541. 2s. 2d., not quite £1,000 per diem, the rate of income anticipated in the last Report.

Deducting the sums to be immediately disbursed, the realized Assets of the conjoint Companies on the 30th of June, 1858, were £1,752,535. 14s. 5d.; and since the interest received amounts, as above shown, to £79,650. 19s. 4d., it follows that the Company's funds of that date, productive and unproductive, have been accumulating during the year at the average rate of £4. 11s. per cent.

The payment for claims on decease of Lives Assured is large in the abstract, but it does not much exceed the average of 2½ per cent. on the total amount assured.

The expenses have unavoidably increased; they are, however, not quite double what they were twelve years ago, while the Company's business is now six times greater than it was then; hence the rate of the expenditure is reduced during that period about 66 per cent.

The Balance Sheet is as follows:—

BALANCE SHEET.

LIABILITIES.		£	s.	d.	ASSETS.		£	s.	d.
Interest due to Proprietors		6,552	11	4	Amount invested in Fixed Mortgages and Life Interests		1,206,484	9	11
Claims on decease of Lives Assured and additions thereto unpaid		58,803	13	7	Ditto decreasing Mortgages		156,801	1	11
Cash Bonus due to Policy-holders		14,966	2	3	Ditto Reversions		61,478	15	7
Sundry Accounts		7,028	5	5	Ditto Funded Property and Government Annuities		162,847	17	2
Value (1857) of Sums Assured		4,013,211	8	6	Ditto temporary Securities		107,021	10	6
Proprietors' Fund		£203,850	0	0	Current Interest on the above Investments		23,574	12	9
Surplus Fund, as above		659,013	17	2	Cash and Bills		21,394	4	6
		662,963	17	2	Advanced on the Company's Policies		82,101	13	6
					Agents' Balances		23,728	2	3
					Sundry Accounts		6,361	14	5
					Value (1857) of Assurance Premiums		3,109,681	15	9
		£4,963,425	19	3			£4,963,425	18	3

Examined and found to be correct,

(Signed) THOMAS ALLEN,
WILLIAM HENRY SMITH, Jun., } *Auditors.*

Here it will be seen that the total Assets of the Company, realized and to be realized, are not much short of £5,000,000; those of the former description amounting to £1,853,744. 2s. 6d., and those of the latter to £3,109,681. 15s. 9d.

The Surplus Fund has increased (mainly by the junction with the Albion) from £482,879. 7s. 7d., in 1858, to £659,013. 17s. 2d. in 1859, the increase being £176,134. 9s. 7d.

It must not be forgotten, however, that the true amount of this fund, which constitutes the provision for future bonuses and expenses, can be determined only by a revaluation of all the Company's Assets and Liabilities; and this revaluation, the Proprietors are aware, will next be made in 1862.

Meanwhile, as the amount of the fund is large, it may prevent misapprehension to point out, that in the accounts of a Life Assurance Company made up as these are, the surplus fund should never be reduced below a certain amount, to be regulated from time to time by the ascertained value of the income; and that it is the excess accruing in the fund, over and above this amount, and not the fund itself, which is properly divisible at the epochs appointed for the distribution of profits.

In the case of the Eagle, this excess is, at the present time, no doubt, considerable; and the Directors have every reason to believe, that when the time arrives for the next division of profits, the amount of it will be such as to give ample satisfaction to all concerned.

The Trustees and Directors of the Company are now as follow:—

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ACTUARY & SECRETARY.

EDWIN JAMES FARREN, Esq.

Considering the present extent and nature of the transactions of the GRESHAM, the Directors have deemed it advisable to apply to the Bank of England, for permission to exercise the Corporate function of investing in the Public Funds, under the Society's Common Seal, and are glad to be able to say that the permission has been granted.

Without wishing, in the least degree, to forestall the result of the elaborate calculations which will be made, prior to the declaration of any new Bonus, the Directors think it perfectly legitimate to contrast the present state of the Society at this period, as compared with that of the year before the Bonus of 1855.

At that date the new Premiums were £7,129. 18s. 5d.; the current Premiums, £35,379. 9s. 1d.; and the Funds, at interest or actually in hand, exclusive of Deposits, were £69,689. 4s. 10d.

At the close of the past year, the new Premiums were £28,208. 2s. 10d.; the current Premiums, £85,598. 12s. 4d.; and the Funds, at interest or actually in hand, exclusive of Deposits, £184,609. 19s. 2d.

It is not the intention, by such comparisons, to offer any suggestion as to the amount of the ensuing division, or as to Gresham Bonuses generally. On the contrary, persevering in the same course of caution which the Directors have always endeavoured to uphold, they will seek rather to err on the side of safety, than even approach the line of imprudence, in such important transactions. With such results, however, as the above to offer, they have thought it right to exemplify the great progress the Institution has made within so short a period.

Policies are effected without loss of time, formalities being carried through at the Office every day, from 10 to 4; Saturdays, 10 to 2; Medical Officer, daily, at 11. The Board assemblies on Thursdays, at half-past 12.

Loans may be obtained in connection with Policies effected with the Company. There has been advanced in this respect upwards of a Quarter of a Million since July, 1848.

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At the Five Divisions of Profits made by this Company, the total Reversionary Bonuses added to the Policies have exceeded £913,000.

At the last Valuation, at Christmas, 1854, the Assurances in force amounted to upwards of £4,240,000: the Income from the Life Branch in 1854 was more than £200,000; and the Life Assurance Fund, after Division of Profits (independent of the Guarantee Capital), exceeded £1,540,000.

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MEDICAL FEES paid by the Company, and no charge will be made for Policy Stamps.

Notice is hereby given, That Fire Policies which expire at Christmas must be renewed within fifteen days at this Office; or with Mr. SAMS, No. 1, St. James's Street, corner of Pall Mall; or with the Company's Agents throughout the Kingdom; otherwise they become void.

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VOLUNTEER RIFLE CORPS.—No extra Premium is required for service in these Corps within the United Kingdom.

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Years in force in 1858.	Age on effecting Assurance.	Sum Assured.	Addition to Sum Assured, in the event of death before 1st July, 1863.	Years in force in 1858.	Age on effecting Assurance.	Sum Assured.	Addition to Sum Assured, in the event of death before 1st July, 1863.	Years in force in 1858.	Age on effecting Assurance.	Sum Assured.	Addition to Sum Assured, in the event of death before 1st July, 1863.
10	33	£999 19	£366 4 0	14	44	£1000 0	£286 1 0	10	27	£500 0	£120 6 0
17	39	999 0	306 17 0	13	32	999 0	272 17 0	9	25	499 19	112 12 0
16	41	3000 0	958 19 0	12	34	499 19	141 16 0	7	31	499 19	93 7 0
15	43	499 0	143 6 0	11	33	999 0	264 9 0				

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	£.	s.	d.	£. s. d.		£.	s.	d.	£. s. d.
15	1	11	0	1 15 0	40	2	18	10	3 6 5
20	1	13	10	1 19 3	50	4	0	9	4, 10 7
30	2	4	0	2 10 4	60	6	1	0	6 7 4

ROBERT TUCKER, *Actuary & Secretary.*

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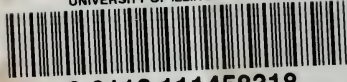
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